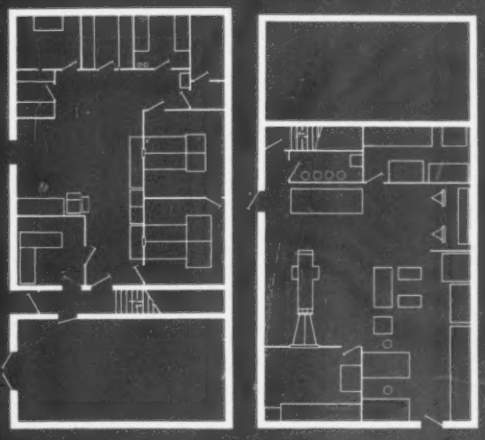
PMI

VOL. 3 NO. 9
SEPTEMBER
1 9 6 0
PRICE 50c

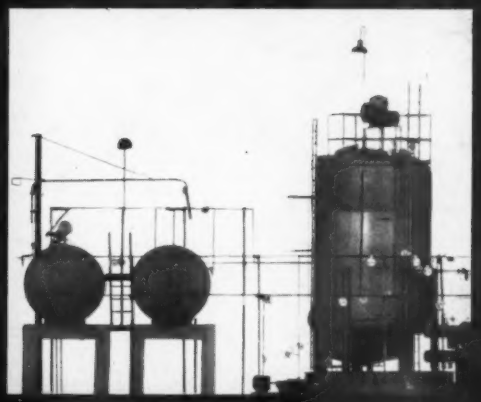
PHOTO METHODS FOR INDUSTRY

Flip Schulke: industry with a 35



Allis-Chalmers' photo beehive

A-V in industry



P&G Camera battles perspective

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unibath the modern way to industrial and professional processing automation

The proven *Unibath* system offers many advantages to the practicing photographer and processor. Six advantages to your photographic processing are listed below:

1 **MORE SPEED.** In exactly 10 minutes, your films are developed, fixed, washed, dried, ready for printing! UNIBATH CC1 or CC2 develops and fixes in 6 minutes, washing takes 1 minute, UNIDRI Rapid Film Dryer takes 2 minutes, air-exposure 1 minute. For archival quality, wash for 5 minutes instead of 1, bringing total time to 14 minutes.

2 **COMPLETE UNIFORMITY**—PICTURE TO PICTURE, ROLL TO ROLL. UNIBATH maintains absolute uniformity of results over its long life. UNIBATH produces identically uniform results from any type exposure: flash, daylight, tungsten, strobe, etc.

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UNIKIT Sr. Portable Darkroom (Model B) includes CC1, CC2, UNIDRI, UNITANK, UNITIMER, Dilution Bottle, Film Clips, Data Charts, Changing Bag, sturdy carrying case.

James Atherton and Maurice Johnson, UPI White House Photographers, get many benefits at once as they process their films in UNITANK at Airport. UNIBATH SYSTEM maintains highest quality

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*CC1 for Regular film development. Liquid: 1 gallon (dilution 1:1). Powders: to make 1, 3½, 5, 10, 25, 50, and 100 gallons.

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*CC7 for Microfilm, Negative Type.

Now in field test:

*CC4 for X-Ray films, both screen and non-screen.

*CC5 for Lithography – high contrast lith types.

*CC6 for Motion Picture–positive type films.

*CC8 for Oscillography–recording films and papers.

*CC9 for Metalphoto Processing.

*C10 for Photofinishing Laboratories.

*CC11 for Phototypesetting Processing.

*UNIDRI Rapid Film Dryer. Cuts drying time in half.

*UNIGEL: any UNIBATH formula in viscous state.

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Get more information. Circle 429, page 77

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the most talked-about camera in years

HEILAND PENTAX H-2

No wonder photographers are talking about the Pentax! It's the lightest, trimmest camera in the entire single lens reflex field. And it's simplicity itself to operate, with no unnecessary, complicated gadgets—just precision controls that help you get the best pictures you've ever taken—

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- the instant return mirror gives uninterrupted, follow-through viewing.
- the automatic diaphragm operates only when you want it to.
- the single, non-rotating speed dial has speeds from 1 sec. to 1/500 sec., plus Time and Bulb.
- the razor-sharp, 6-element 55mm f/2.0 Auto-Takumar lens is the fastest available for the price.
- With this lens, the Heiland-Pentax H-2 is only $179.50.

There's a complete line of Pentax accessories and interchangeable lenses, too—from macro attachments for extreme close-up work to a 1000mm lens that will bring out the smallest features of subjects half a mile away.

See the Pentax demonstrated now at your photo dealer, or write for free folder, describing the Pentax and the complete line of eleven lenses, and accessories.

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Get more information. Circle 442, page 77

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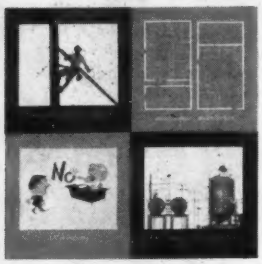
PMI
PHOTO METHODS FOR INDUSTRY



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Sharper than a needle...

Uncropped, unretouched photo by Harvey Shaman using Minolta SR-1, 100 mm Rokkor lens at f:16 for depth of field, extension bellows at 0.5 magnification, strobe light at 1/50 sec.

Captured by the rare earth Rokkor lens, exclusive with

MINOLTA SR-1

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Instant return mirror • Automatic diaphragm • Double-bright viewing, condensing and Fresnel System • Non-spinning shutter speed dial, 1 to 1/500 & B • Lock-in half stops • Automatic reset counter with magnifier window • Double coated f:2 lens needs no UV filter • Rapid rewind • Separate FP & X sync terminals • 1/8th turn bayonet lens mount • Self-timer with built-in bypass • Matching LVS numbers.

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Your Graphic Arts material supplier will tell you all about the LEEDAL line . . . he's as excited about it as we are.

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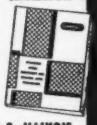
The light tables that let you sit comfortably as you work. Another exclusive LEEDAL feature—easily replaced clear top glass over an unbreakable light diffusion material. Available with or without tilting tops and also as dot etch tables.

PLATE SINKS

Loaded with convenient features: Full length spray pipe; full steel storage shelf; adjustable drain rack (horizontal for rough developing or soaking, slanted for finished developing).

The most beautiful, rugged Graphic Arts equipment made. See the entire LEEDAL line in Catalog No. E-105.



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LEEDAL INCORPORATED

Get more information. Circle 455, page 77

F.Y.I.

Despite the growth of photography and photographic methods, the exchange of information is still limited to word of mouth or the thickness of a reporter's soles. Next month, a two-day seminar at the Rochester Institute of Technology will discuss the possibility of a centralized information service for the graphic arts. Over 60 representatives of research groups, manufacturers, printers and publishers, etc. have indicated interest in the meeting which will be held October 13 and 14. Allen Kent, Associate Director of the Center for Documentation at Western Reserve University will speak at a dinner on Thursday, October 13.

Registration and other information may be obtained from Harold Kentner, Director of Extended Services, Rochester Institute of Technology, Rochester 8, N. Y.

Here we go again department

In the July FYI, we had an item on Movielab Film Labs (they expanded) and we called the president Saul Jaffee. We are informed that his name is Saul Jeffee.

July was a bad month for names with this department. Jules Shulman, whose work was discussed in *Construction Cheesecake* is really Julius.

Please accept our apologies for misnaming you gentlemen.

Leaving our sins behind, we find that the Salvation Army is holding a photo contest to celebrate its 75th anniversary in Chicago. There are two classes of entries: the "symbolic" photos which depict the Army's activities and personality, and the "general" which show the Army's services. Contestants can photograph the Salvation Army at work during a series of open houses. Details can be obtained from the contest committee at The Salvation Army, 860 North Dearborn St., Chicago 10, Ill.

A unique project is one initiated by a French engineer, Alexis N. Vorontzoff. He is assembling an international catalog of films on atomic energy. It seems some 400 pictures on all phases of the atom have been made. If anyone has information on such films, he is requested to contact Mr. Vorontzoff at 10 rue Mademoiselle, Paris 15, France.

This is positively the last notice we will print on the 1st ASMP Photo-Journalism conference at Asilomar, Calif. The reason is not personal: we have a great admiration for ASMP but the conference will take place September 21 to 24 and our next issue will be out in October. Speakers include Ansel Adams, Ray Mackland, John Morris, Julius Shulman (the very same), etc. Registration fee is $20. For details, write the University of California, Berkeley.

To return to the world of commerce and industry . . .

Bach Auricon is providing a package deal for the in-plant man who wants a complete motion picture outfit. Built around the Auricon Pro-600 sound-on-film camera, the unit includes ColorTran 1000-watt main fill light plus fill and back lights, ColorTran converter, barn doors, scrim, cables, cases, etc. This outfit provides basic sound equipment for most in-plant requirements.

Newly-elected officers of the Association of Federal Photographers include: Woodrow Wilson, president; Edwin Weinberger, vice-president; John McClain, secretary; Albert Candido, treasurer. Address of the group is P. O. Box 1027, Washington 13, D. C.

Commercial and other notes

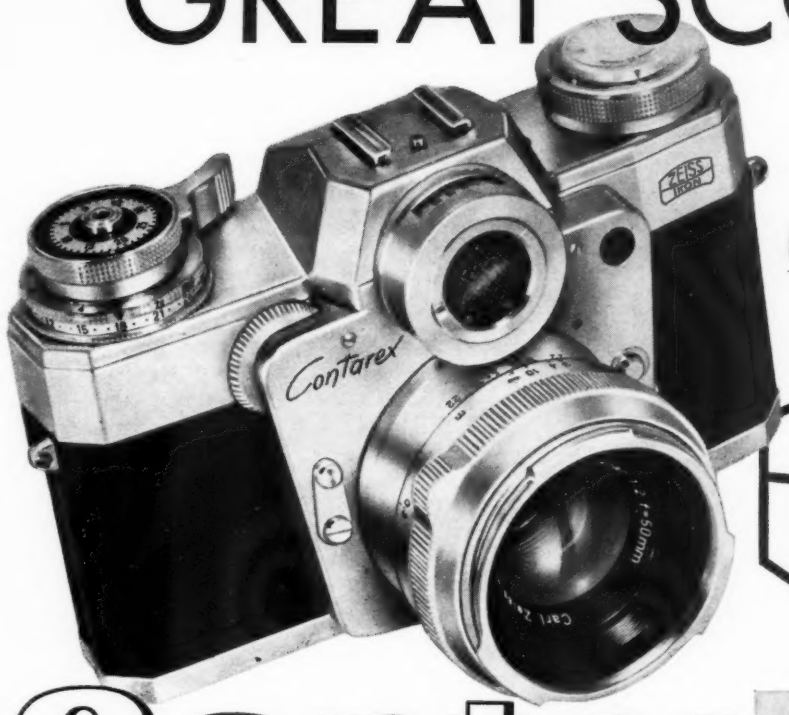
Fairchild Camera and Instrument Corporation will represent American Speedlight Corporation in export sales of Ascorlux Xenon Arc equipment for the graphic arts. Handling the details will be Fairchild's Dutch subsidiary with offices and distributors in over 50 countries.

Anken Chemical and FR Corporation have announced preliminary plans for the cooperative introduction of a color-print paper. Under the proposed plan, Anken will make the paper and FR the processing chemicals. A new corporation will handle distribution.

San Francisco is the home of one of the newest movie production companies, Cine-Chrome productions. Headed by Dick Ham, the company will specialize in report, training

(*continued on page* 18)

GREAT SCOPE with few accessories



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WEST GERMANY

Contarex

Acclaimed as a striking achievement in 35mm camera design. A new high in versatility, automatic operation and precision control.

Contarex, with its standard Planar f/2, 50mm lens is ideal for a great variety of subjects. Five additional Zeiss lenses provide virtually unlimited range—from wide-angle coverage of 90° to striking telephoto pictures taken at an angle of only 10°. Just a few accessories are required for micro and macro photography.

Light meter has unique interlock which lets you pre-select either the shutter speed or lens opening for automatic exposure control. Normal loss of light at close distances is automatically compensated for in the lens. To intentionally over or under expose, you simply disengage the interlock.

Viewfinder gives natural size image of incredible brightness, and incorporates a split-image rangefinder in ground-glass ring for ultra sharp focusing.

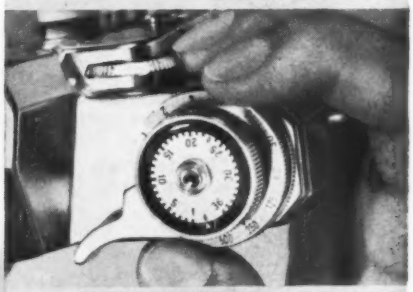
A demonstration will be a revelation to you

See your Zeiss Ikon dealer. Literature on request.

CARL ZEISS, INC., 485 FIFTH AVENUE, NEW YORK 17

INTERCHANGEABLE ZEISS LENSES—All are color matched for identical rendition on color film.

Exposure meter has provision for reflected and incident light readings. Its sensitivity can be increased 16 times by simply removing the baffle.



Focal-plane shutter has speeds to 1/1000 sec. and is fully synchronized. Each speed is color coded and synchronization adjusts automatically as a speed is selected.

Get more information. Circle 499, page 77

REPRODUCTION TRENDS

In fifteen minutes, the small stack of copies above was made from a weak original drawing. In exactly the same time, two POST *Intermediate copies of the drawing were made and, in turn, produced the large stack of better-grade copies.*

Get better prints, faster production, using POST Intermediates

Direct-positive ammonia prints are a well-accepted technique in copying engineering drawings. Less commonly known is the time-saving technique of making a reproducible intermediate better than the original by the same process—using highly sensitive, Control-Coated POST Intermediate Prints on vellum, cloth or film.

POST Intermediates provide not only a translucent duplicate master for direct pencil or ink alteration, but a copy which often can actually reproduce stronger, denser image lines than the original.

Making a subsequent intermediate copy from the first POST intermediate, and another from the second one, gives maximum image density for rapid diazo printing, yet without objectionable build-up of background tones. This applies whether ten copies or one hundred are made, whether all at once or over a period of time, whether from one POST Intermediate or several. And, for really fast print production, one operator can feed up to four intermediates in rapid sequence.

Such products as POST Vapo-Vel, Filmtex, Tuf-Tex and Vapo Cloth can often help your company solve the problem of salvaging old originals—can give a very stable, accurate, long-lived "original" for fast, multiple print-back—at a cost only slightly higher than regular diazo prints.

For a complete kit of POST Intermediate materials and application information, ask your POST dealer or write Frederick Post Company, 3660 North Avondale Avenue, Chicago 18, Illinois.

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BLUE PRINT AND SEPIATONE PAPERS • DIAZOTYPE (VAPO AND SEMI-MOIST) PAPERS, CLOTHS AND FILMS
WASHOFF REPRO MATERIALS • PHOTOGRAPHIC DARKROOM (REFAX) & ROOMLIGHT (AUTOFAX) CLOTHS & PAPERS

Get more information. Circle 481, page 77

LETTERS

To the Editor:

We read with interest your article, "8mm Sound," in your recent issue. This article should be quite valuable to a number of people as it is the first we have seen that summarizes and compares the various 8mm sound projectors now available.

We do wish to call your attention to one error in this article. You state that the first 8mm projector using magnetically striped film was the Elite Projector of Tandberg. We believe that the first magnetic sound projector sold was the Movie Sound 8, developed by Lloyd Thompson of the Calvin Company and sold by the Calvin Company in 1952. This projector was in production and sold several years before being withdrawn from the market. It is our understanding that this was the first such projector sold and was before the Elite.

Right now, we are again working in the 8mm field, particularly in the development stages of high-speed release printing equipment. As we are rather proud of our "first" back in 1952, should it be convenient for you to acknowledge this, we should greatly appreciate it.

William D. Hedden
Calvin Productions, Inc.
Kansas City, Mo.

To the Editor:

For my Speed Graphic equipment I have a vulcanized-fiber case which I believe was built by Graflex. It is very satisfactory because it is light and strong for its size.

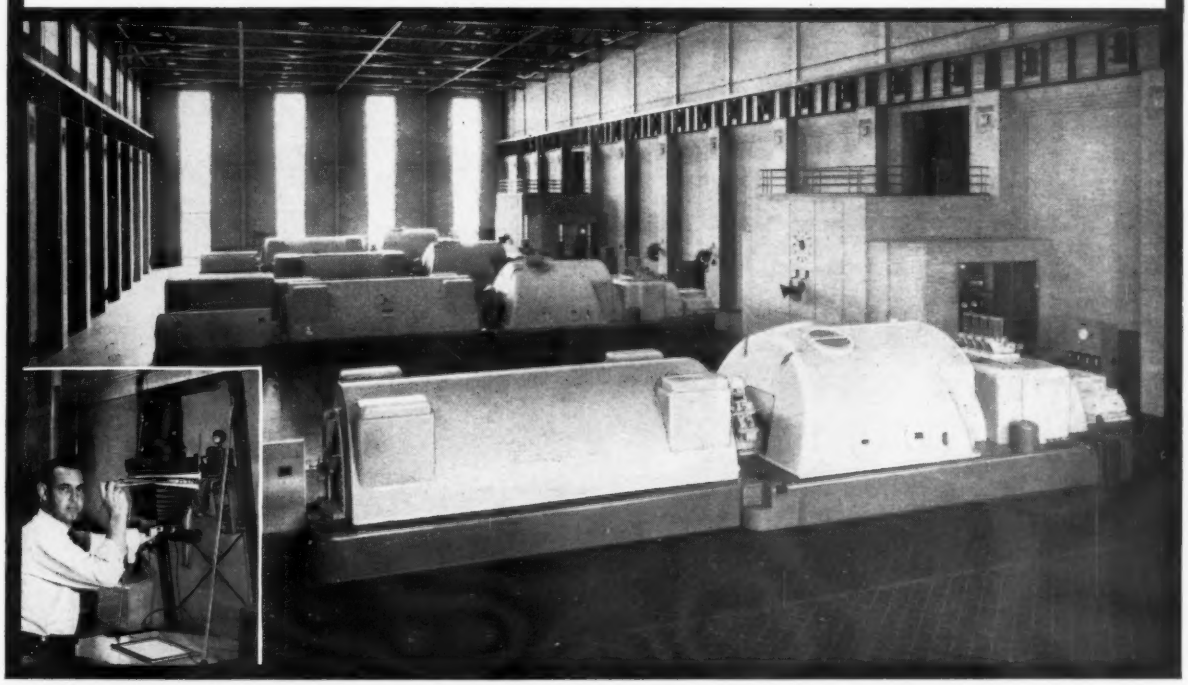
I wish to prepare a case to hold my Rolleiflex and Ikonta and the necessary equipment (flash, flash extension, close-up lenses, etc.) which I will line and paint white. But the only Graflex cases I've seen are too large and heavy. It appears that I need something about 11 or 12 inches long, 9 inches high and 9 inches wide.

Could your staff suggest a source for such a light, strong, tight case?

Robert Alldredge
Denver, Colo.

We suggest you consult the Denver telephone directory under "sample cases" for local suppliers or contact the following: Durable Fibre Sample Case Co., 42 E. 20 St., New York, N.Y.; Fiberbilt Case Co., 40 W. 17th St., New York, N.Y.—Ed.

HOW BESELER MET ENLARGER REQUIREMENTS FOR NIAGARA MOHAWK POWER CORPORATION



"The photo of myself was taken with a Beseler Topcon, printed on a Beseler enlarger and dried on a Beseler dryer."
C. G. MOYNIHAN

Mr. Cornelius G. Moynihan, of Albany, N. Y., official photographer for Niagara Mohawk Power Corporation's Eastern Division, handles virtually all company photography in that division without assistance. Constant call for black and white and color enlargements for engineering, public relations, advertising, and the company house organ posed this darkroom problem that the Beseler 45MCR solved.

REQUIRED:

An enlarger that permitted fast, constant shifting between black and white and color as well as between different negative sizes – without costly, time-consuming equipment modification.

BESELER 45MCR BECAUSE:

The Beseler 45MCR twin condenser system provided the speed, and the quality, required. It eliminated the need for purchasing or changing condensers for negatives from 8mm up to 4" x 5". Negatives were placed at the optically correct point within the cone of light, producing a flat, even field of illumination. In addition, color printing required no modification or accessories . . . and no compensation was required for color balance variations that occur when condensers must be changed.

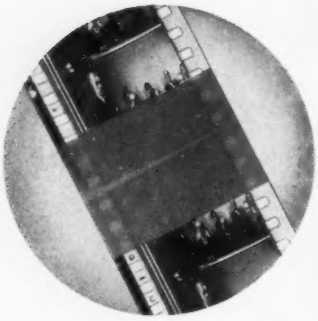
LET BESELER SOLVE YOUR DARKROOM PROBLEMS . . . OUR TECHNICAL DEPT. IS AT YOUR SERVICE

For Photo Dept. Beseler Topcon / For Lab Beseler Dryers / For A-V Dept. Beseler Slide-King

CHARLES BESELER COMPANY 204 South 18th Street, East Orange, New Jersey

Get more information. Circle 409, page 77

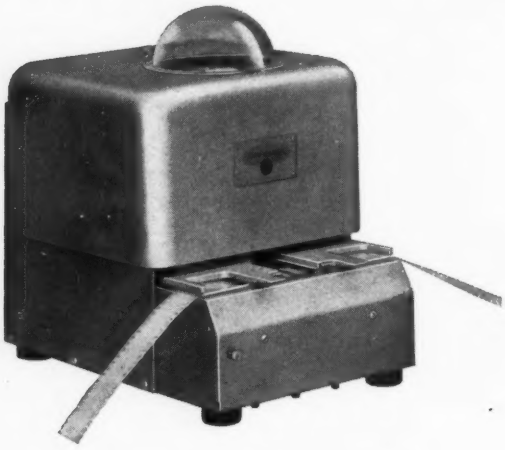
Perfect Darkroom Splices in 8 Seconds!



With the

UNICORN

AUTOMATIC FILM SPLICER



The Unicorn film splicer produces perfect, unbreakable splices in just 8 seconds. It speeds up processing by eliminating down time and jamming caused by staple and hand splices. The use of Mylar tape assures no-break bonding, and automatic operation permits uniform splices, even in darkroom production.

The two ends of the film are butted and the tape is completely wrapped around, forming a smooth splice for free passage through film processing machines, squeegees, and applicators. Safe, simple push button control allows operation by semi-skilled personnel. Three standard models are available for splicing 16, 35 and 70mm film stock.

Splicers are ruggedly built to give continuous service for long periods of time. They are widely used by commercial, industrial, and military film laboratories. For more details on how the Unicorn splicer increases production volume, please write to:

UNICORN PRODUCTS DIVISION

Computer-Measurements Company

Dept. 88 12970 Bradley Avenue, Sylmar, California

OTHER UNICORN PRODUCTS: SOLVENT FILM CLEANERS • PRINTER ROBOT • KEYBOARD PERFORATORS • LIGHT INTENSITY CONTROLLERS • MECHANICAL FILTERS COLOR TIMERS • FADE ROBOTS • FILM SLITTERS • POWER REWIND

Get more information. Circle 425, page 77

COMING UP

SEPTEMBER 21-24 Photojournalism Conference sponsored by American Society of Magazine Photographers. Asilomar Conference Grounds, Asilomar, Calif.

SEPTEMBER 22-23 Photographic Instrumentation Institute. University of Wisconsin, Madison, Wisconsin. Contact C. F. Hurc, Dept. of Engineering for program.

SEPTEMBER 26-30 Instrument Society of America's 15th Annual Instrument-Automation Conference and Exhibit, New York, N. Y.

SEPTEMBER 24-OCTOBER 7 Photokina-International Photographic Trade Fair. Cologne, Germany.

OCTOBER 5-8 National Association of Photo Lithographers Convention, Chicago, Illinois.

OCTOBER 10-13 Fourth Annual Industrial Film & A-V Exhibition. New York, N. Y.

OCTOBER 13-14 Graphic Arts Centralized Information Service Conference. Extended Services Division, Rochester Institute of Technology, Rochester 8, N. Y. Contact Harold Kentner, director, for information.

OCTOBER 14-15 High-Speed Processing Symposium sponsored by Society of Photographic Scientists and Engineers (SPSE), Shoreham Hotel, Washington, D. C.

OCTOBER 16-22 5th International Congress on High-Speed Photography sponsored by Society of Motion Picture and Television Engineers (SMPTE), Sheraton Park Hotel, Washington, D. C.

MONTHLY MEETINGS

Association of Federal Photographers Meetings every third Wednesday at 8 p.m. G.S.A. Building, 7th and D Sts., S. W., Washington, D.C.

Cleveland Chapter SPSE Meetings the first Tuesday of each month. Cleveland Engineering & Scientific Center, 3100 Chester Ave., Cleveland, Ohio. Contact Robert E. Birr, General Electric, Nela Park, Cleveland, Ohio. GL 1-6600.

(*continued on page 72*)

the inherent versatility that works for you in the **NIKON F**

When you first look at a Nikon F, you can't help but be impressed by its orderly, uncluttered appearance. It has the unmistakable look of quality and precision. You pick it up and sight through the finder, and you're equally impressed by the brightness of the image – the ease with which it focuses. You try it – the film advance lever, the depth-of-field previewer. You fire the shutter once or twice. You are now even more impressed than before–the automatic operation, the effortless ease and speed with which it handles and responds.

These are qualities of the Nikon F which you discover immediately. But, there are others, less apparent, which are no less essential.

Probably the most important feature of the 35mm reflex is the finder system – the pentaprism and the screen. Let us consider them individually. As valuable as the eyelevel pentaprism finder has proved to be, there are instances when its use is less than ideal. For example, where conditions require shooting over the heads of people in a crowd, a waist level type would certainly be more practical. Similarly, for astro and micro-photography, most users prefer the waist level type with its magnifier. *The fact that the Nikon F is equipped with a removable pentaprism which can be easily and quickly interchanged with a waist-level finder, is an example of the versatility built into the Nikon F.*

Now, the focusing screen–its purpose is to allow you to focus accurately, to compose and frame the picture, to observe, and even to select desired depth of field. Some cameras offer a screen with a central split-prism rangefinder as an added aid to focusing. Others have a matte-ground center spot. One camera has a screen in which the area used for focusing is so small, that it is virtually impossible to observe depth-of-field.

While the type of screen desired is, for the most part, a matter of personal preference, there are applications for which one type is actually more suitable than another. Many find the matte-spot type superior to the split-prism for use with long focus lenses; while for photography through optical instruments–microscopes, telescopes, etc. – a clear central spot screen is generally preferred because it permits aerial focusing. *The fact that there are three screen types available for the Nikon F – split-prism, matte-spot and clear-spot –and that they are all readily interchangeable, is another example of the versatility built into the Nikon F.*

The split-hair accuracy of the Nikon F finder system deserves special attention. *One*–no matter what the angle at which the camera is held – even upside down – the mirror always returns to the same precise focusing position. *Two*–no matter what screen is used. The finder area is precisely the same as the area of the film aperture in the camera; *the image recorded on the film is precisely the same as the image seen in the finder–no more, no less.*

Some of these features may or may not relate to your immediate needs. Yet, they become of utmost importance when certain situations arise. In any case, they do demonstrate the caliber of thinking, the foresight and the effort that have gone into making the Nikon F a quality instrument of almost unlimited versatility–an invaluable tool, always ready to work with you, and help you meet and cope with any picture challenge.

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David B. Eisendrath, Jr.

WORKING PHOTOGRAPHER

Some comments on the national industrial photographic conference

Most of the formal papers and presentations which were given at the Eighth National Industrial Conference in Chicago in August will be reviewed, reprinted, and widely quoted. If you are a member of the Industrial Division of the Professional Photographers of America under whose auspices these meetings are held, you will eventually get a complete transcript of almost every performance.

However, being a gadgeteer myself and having a quick eye for the unusual idea, trick, quirk or gadget —I am always intrigued by the oddball idea or comment and especially on some of the things that go unreported in the bull sessions. So, herewith some observations overheard at these sessions:

Hit up middlemen

From a session on how to get a raise and recognition: someone suggested that most often *top* management is already sold on photography but photographers should examine the attitude of the *middle* range management level and see whether a selling job needed to be done there. Dick Kinstler of Procter and Gamble said his observation was that too often an industrial photo department tried to oversell its own importance. Instead, he uses the approach, "How may *we* be of service to *you*," subordinating the angle of being photographers, but stressing the idea that you are company men and want to help everyone to do a better job for the company.

Howard Hood of General Electric said that his department had improved its status and morale, to say nothing of its position with management by scheduling a weekly meeting and making a report on just what the lab had done during the past week. Hood's reports show what the lab does, what it can do and what it plans to do. The weekly report, he says, helped bring the support of mid-level management. Someone else then told how they had suggested to engineers that they make a picture report of what machines were in the shop, as sometimes working front-office engineers just forgot what machines looked like and what they could do. They also numbered controls and parts on the machines so the engineers could refer to them when discussing them by phone with one another, or in describing modifications or adjustments. This suggestion proved worthwhile, the photo department was invited to make more suggestions and has had more respect, jobs, and increased budget. Several other voices suggested that they constantly tried to think of money-saving suggestions, in reply to this reporter's comment that he sincerely believes that one of the quickest ways to management's heart and ear is through the pocketbook.

Ed Paeltz of Laclede Steel added that his constant slogan is, "Don't sell the photograph, sell the service." And he added that many times when they think they can save money for management they go out on their own to make presentations to show what they can do. They borrowed a high-speed camera, for example, from friends at another plant, made a high-speed picture of a machine that was giving trouble, showed the film to management, and within a week they were in the high-speed business with a camera of their own. He encouraged photographers to spend their free time getting out in the plant to see what's going on. Every walk through the plant on the way to and from a job should be made with eyes wide open for ideas.

Jim Cooper of the University of Michigan's Willow Run Labs said that by way of advertising they had mounted two neat 4 x 8 peg boards in the hallway outside the department and post exhibits of what they could do and were doing. Jim said they arrange displays in modules so they can easily replace or rearrange. Ostensibly done for visitors, it helps

(*continued on page* 14)

How professional should a camera be?

How much camera should a pro invest in?

First, it depends on the features he needs. If he's like most pros he can't begin to itemize the hundreds of different types of jobs he handles—everything from portraits to microphotography. In the long run he might wind up buying half a dozen "specialized" cameras to fill his requirements.

The single lens reflex Hasselblad eliminates this. With *one camera*, plus interchangeable accessories, you can get over 100 combinations, and set up in seconds for practically every shot known to photography. Four different lenses, three film magazine sizes plus a sheet film holder, four types of viewers—everything changes. The Hasselblad makes it absolutely needless to carry more than one camera on an assignment.

Next, a pro wants quality. How much? Enough to guarantee him perfect results under any circumstances. After all, his living depends on it.

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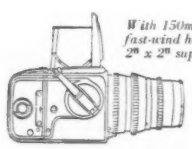
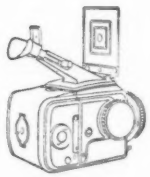
The precision single lens reflex system, of course, completely eliminates parallax. Focus and depth of field appear on the print-size ground glass just as the film will take them. A pop-up magnifier allows you to focus accurately on minute details. There are no surprises waiting for you in the darkroom with a Hasselblad.

Even the ***"conveniences" on the Hasselblad,*** the EVS system, automatic diaphragms (which can also be set manually), and automatic safety devices are to make assignments easier and free you to concentrate on the job. When you use an instrument every day, you have a little convenience coming to you.

How professional should a camera be? As professional as a Hasselblad, *no less.* With Zeiss Planar 80mm f/2.8 lens, $489.50, including F.E.T. Write Dept. HPM-9 for literature and the name of your nearest Hasselblad dealer. PAILLARD Incorporated, 100 Sixth Ave., New York 13, New York.

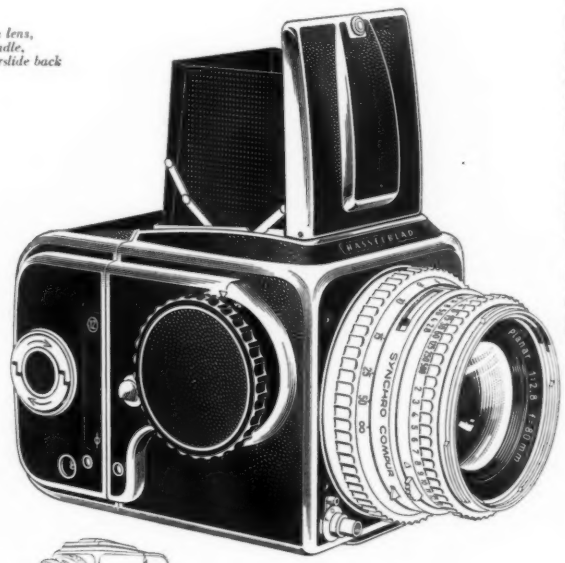


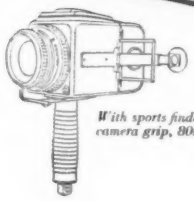
With 150mm lens, fast-wind handle, 2" x 2" superslide back



With prismatic sports finder

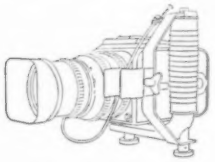
With magnifying hood, 60mm lens, back for 16 1⅝" x 2¼" exposures, exposure meter knob



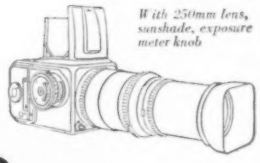


With sports finder, camera grip, 80mm lens

With magnifying hood, cut film adaptor and holder



With 150mm lens, sunshade, flash gun bracket, back for 12 2¼" x 2¼" exposures



With 250mm lens, sunshade, exposure meter knob

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WORKING PHOTOGRAPHER

(*continued from page* 12)

impress others of the type of work they are capable of turning out. Howard Hood said that by way of stimulation they have monthly photo contests. The plant manager and other executives serve as judges. This keeps the good work before management, arouses interest in what they're doing. Winners are posted.

Someone asked Hood where they got funds for awards, or did they get them from outside. Howard said that although outside vendors might be persuaded to offer prizes, they merely gave a free dinner to the winners, as one of their weekly meetings ran into an evening session.

How much for color

The subject changed at this point and a photo department manager asked how much equipment he needed to get into color printing. He said he'd been told he needed a great deal. Ken Knollenberg of Bethlehem Steel said he didn't think you could afford to do your own color unless you had more than a thousand dollars worth of work a month at a photofinisher. Someone else added that if the lab was now doing black-and-white they could convert to color very inexpensively. (Jack Allsup of A. E. Staley Co. pointed out in a talk a few days later that he had gone from black-and-white into color printing for less than a $200 expenditure.) I added a note that unless large volumes were to be processed, really all one needed was a good thermometer and timer and a set of good printing filters.

The question was asked: how can we get our management to buy us a new Hasselblad camera? Answer, do what we did, we subscribe to Paeltz's theory, we borrowed one, did such a good job with it they wanted to know why, soon had one in our budget.

Sharp aerials

And then: I have to make air pictures of my plant for a big color print mural and can't get satisfactory color negatives. Suggestions made: use a bigger camera. Buy a surplus K-17 and shoot sheets of 8 x 10. Orlin Donaldson of Bethlehem Steel added they had excellent results from this. He added they'd also rented a Kenvon Gyro Stabilizer, one of those hand gyroscopes that dampen camera vibration. Another suggested using support springs from the plane roof to hold weight of camera and dampen vibrations. Another commented that they discovered when they shot from right hand door they got sharper pictures than when shooting from left, discovered that wind whipping around camera was going into film holder through slide slot, was vibrating film .Small flap on camera to weather-strip eliminated that. Another idea was that in using large film holders, film did tend to pull away from back of holders sometime and use of Scotch 666 tape in center of holder would hold film back and keep it from shaking. (Scotch 666 is not a cousin of Vat 69 but a double sided tape.)

Hot point

Next query concerned a Saltzman enlarger where the mercury vapor lamps had extremely short life. Suggestions were made to check ventilation, voltage and line surge from nearby electrical users. Final solution, if these didn't work, to replace with an Aristo Cold Grid Light. This led to the inquiry about how to get a ventilating fan without really getting heat prostration. Someone told story of Walter Lawton of Stanford Research Institute who had asked his management for proper ventilation in projection booth. The request was ignored until he had a management audience in the theater and began inserting his own slides telling what the current temperature in the booth was! When he finally showed a thermometer at 112° they got the point!

Slide troubles

Stan Lentz of US Steel Research Labs asked about eliminating Newton rings when contact printing lantern slides. I suggested that he see whether the rings were formed between the negative and the contact printer glass or between negative and lantern slide. If formed between negative and printer, use of Tru-Site picture frame glass in the printer would eliminate these. This is a treated picture frame glass that shows no reflection. If the Newton rings were formed between negative and glass slide, then a very light application of printers' off-set powder would do it. This is a microscopically fine powder and tends to break up the juxtaposition of glass and film that makes rings. It must be applied *very* lightly—and if you can see it—you have too much on. The Tru-Site glass, is also good in a copy camera for holding copy and eliminating reflection from camera.

On the subject of lantern slides, someone asked how to make slides to be projected for a long time. He had to make charts and graphs and made them on Kodalith film and had trouble with slides buckling from

heat. Someone else pointed out that if you have slides for this purpose, first thing to do is try to get a cool projector. But a slide with lots of black gets hotter because it absorbs more heat. Especially a slide with white lines on black background. So in this case you can harden the emulsion with chrome alum. Another idea is to make the slide on diazo material. Diazo, not being silver, doesn't absorb as much heat. I added that if you had this kind of problem, a good solution was to laminate your slides to glass so the emulsion and the cover glass were laminated together. Of course, lantern slide plates eliminate some of this problem.

Best suggestion for coloring line slides was to use a multicolor diazo like Ozalid's Varicolor or Tecnifax KVR and develop up each color with small brush and color developer for these materials. Others make white line slides on black background and add color by hand with Dr. Martin or Webster Photocolor dyes. Someone said they had trouble applying color to small lined areas without smearing, and another suggested masking slide with Scotch tape as a frisket before applying color.

From this miscellany sampling you can see that the Industrial Conference Bull Sessions were really fascinating and worth while with much to take home.—THE END

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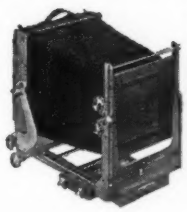

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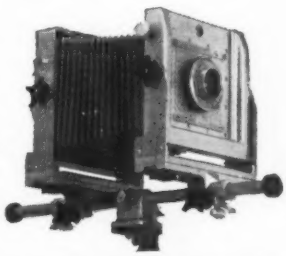

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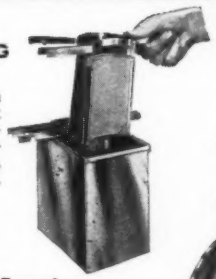

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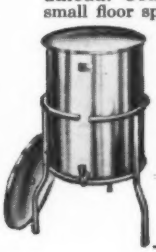

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Samuel Lang & Leonard Zoref

INDUSTRIAL COLOR

Forced processing for increased speed: Ektachrome E-3, Ektacolor

We discussed forcing up the speed of a number of transparency color films in this space in July. This month we'll complete the discussion by taking up the new Ektachrome E-3 and the American negative-positive films.

Before we get to a discussion of forced processing with Ektachrome E-3, we'd like to review our experience with the film in normal use, something we haven't done in this column as yet.

At present it is available in standard sheet film sizes in a Type B (tungsten) and in a Daylight color balance. In addition, a 120/620 Daylight only form is available.

Exposure index of the daylight film is 50, plus or minus ½-stop. The tungsten film is rated at 32 with the same variation. These variations are accurately recorded on a supplemental instruction sheet packed with the film. They are not to be ignored.

(The instructions packed with the Daylight film usually recommend a CC10 yellow filter for use with electronic flash. Our experience is to the contrary. The best results we have seen were without a filter, or with a CC05 blue filter. The only practical way for the photographer to handle the situation is to zero in filter and guide number with his own camera, flash unit, processing and taste.)

Ektachrome E-3 has changed the habits of color men, both those behind the camera and those in the lab. The quality of this recent film represents a substantial improvement over the quality of Ektachrome E-1, which it supersedes. E-3 has finer grain, more transparent highlights, lusher color and greater color fidelity. Along with these blessings, E-3 requires more exacting processing. To bring out the advantages of this film, laboratory control must be no less than rigid.

Let us consider E-3, Type B. This is the more difficult to process. A slight amount of underdevelopment in the first developer causes a cyan cast, which incidentally cannot be filtered out because it affects the highlights as well as the remainder of the image. Overdevelopment results in a yellow-orangish transparency. Fortunately this can be filtered out at the camera lens to some extent.

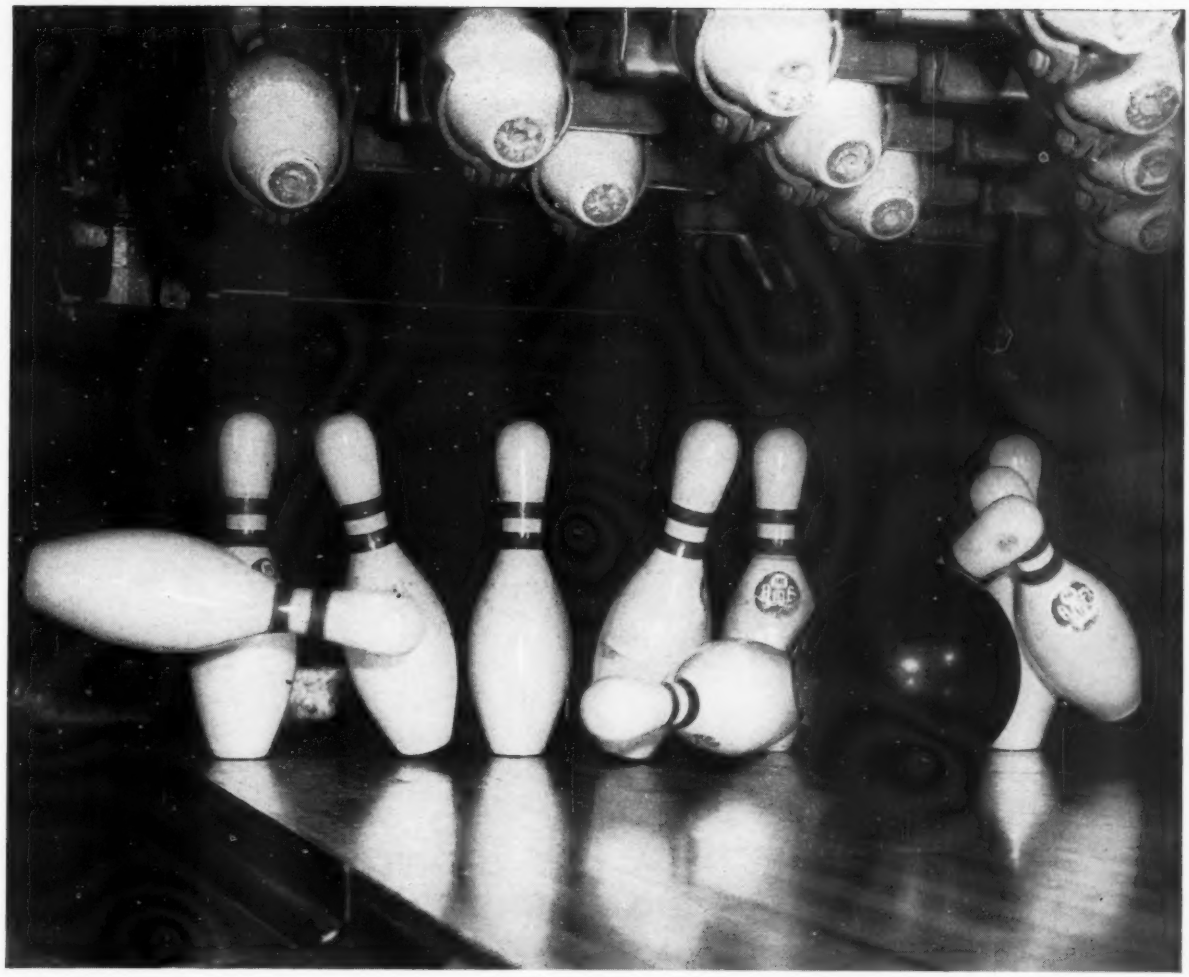
To push the Type B film by one stop, it's best to anticipate a color shift by using a CC10 blue filter on the camera lens, then increase first development by 5 min. If the filter has been omitted, a minus 5 min. development in the color developer is a remedy. Pushing development beyond one stop can cause disastrous results in color balance. We do not recommend it, at all.

The daylight version is less sensitive to processing variations. It holds up better under forced processing. A one-stop push requires plus 5 min. in the first developer and minus 5 min. in the color developer. Usually no filter is necessary with this development technique. Proper agitation and recommended ½-in. spacing between hangers are musts.

Kodacolor and Ektacolor

The negative color films are a special case. Development and coupling take place in the same solution, with development by-products furnishing the basis for formation of a negative color image. Only certain developing agents form the necessary by-products—paraphenylenediamines. They don't push very far.

In view of the limited extent to which pushing can be accomplished, the color distortions that go hand in hand with pushing, and the fact that considerable control is possible in printing the negatives—it is questionable whether pushing color negative films is worthwhile. The best we've accomplished is a one stop increase in speed by giving Kodacolor or Ektacolor an extra 5 min. in the developer.—THE END



Unretouched Super Speed Graphic photo taken by Jim Robbins. Taken at 1/750 second with #5 flash lamps, using Graflite flash unit on camera, two teleflash units, right and left.

A Super Speed Graphic photo taken at 1/750 second with FLASH LAMPS

This photo marks a new milestone in flash photography. Now, for the first time, Graflex makes available to you a shutter that takes fully synchronized pictures at a true 1/750 second with "M" type lamps. It's the Super Speed Graphic's new Graflex 1000 Shutter.

Completely different from conventional shutters, the Graflex 1000 has a unique "orbital" shutter leaf action that admits more light in less time for extraordinary action-stopping ability.

Its ability to cut more accurate, sharper "slices of light" and produce crisp, ghost-free images, makes it ideal for use with the new fast black and white, color and Polaroid films. With electronic flash the Graflex 1000 is accurately synchronized at all speeds up to and including a true 1/1000 second. Super Speed Graphic, complete with 135mm Optar lens in Graflex 1000 shutter, lists for $449.50*. Graflite flash unit, $27.95.

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Imagine a true luxury camera priced to fit the tightest budget ... incredibly sharp Miranda-Soligor f1.9 Automatic lens interchangeable with most other 35mm lenses; instant-return mirror; eye-level pentaprism viewing; synch. shutter to 1/500th second; rapid film advance and rewind and lots more! Plus quiet, vibration-free operation typical of Miranda quality. Ask your dealer to introduce you ... see how much you get for a mere.....**$159.95!**

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Get more information. Circle 446, page 77

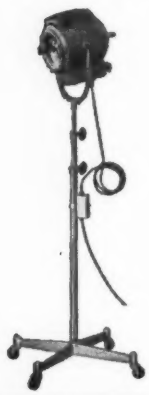
PERFECT LIGHT CONTROL *with*
***RUGGED VERSATILE* PHOTOGENIC**
modeling, spots, and floods

STUDIO MODELING LIGHT

Accommodates 300 to 1500 watt, pearl-shaped incandescent lamps —also #4 Photofloods.
Direct light reflector is adjustable to increase or decrease illumination for hard or soft lighting. Ball-bearing caster base stand raises light from 36" to 10'. Folding stands available.

CP-15 MAZDA FLOODLIGHT

Accommodates all mogul base, pear-shaped lamps, 300 to 1500 watts, #4 Photofloods, or movie floods.
Reflector extension to 9 feet with ball-bearing swivel caster base studio stand.
Folding stands available.



F-750 VARIBEAM SPOTLIGHT

Can be focused from broad flood to small spot. Rotatable barn doors, snoots and focusing spot concentrator available for close ups.
Extendible to 9½ feet — adjustable bracket available for operation at lower levels.
Folding stands available.

FOR FURTHER INFORMATION SEE YOUR AUTHORIZED PHOTOGENIC DEALER OR WRITE DIRECT TO . . .

MANUFACTURED BY
Photogenic Machine Company
YOUNGSTOWN 1, OHIO

Get more information. Circle 477, page 77

F. Y. I.

(*continued from page 6*)

and advertising films for industry. Their address is 4077 Transport St., Palo Alto, Calif.

Criterion Film Laboratories announces their expansion to 10,000 square feet. They are located at 33 West 60th Street in New York.

Roberts and Porter, 622 Greenwich Street, New York, N. Y. are now the exclusive distributors of Promicrol, the British developer which helped create the available light revolution.

AV Congress

The Fourth Annual Industrial Film and A-V Exhibition comes up October 10-13. The advance program promises a three-ring circus: 1) a trade show of motion picture, visual aid, audio and TV equipment for business and education 2) showings of outstanding films, filmstrips and presentations and 3) a series of seminars, workshops and tech talks. Special attentions is given 8mm sound, single system motion pictures, commercial films honored at an advertising film festival in Venice, and closed circuit TV. The whole shebang is held at the New York Trade Show building in Manhattan.

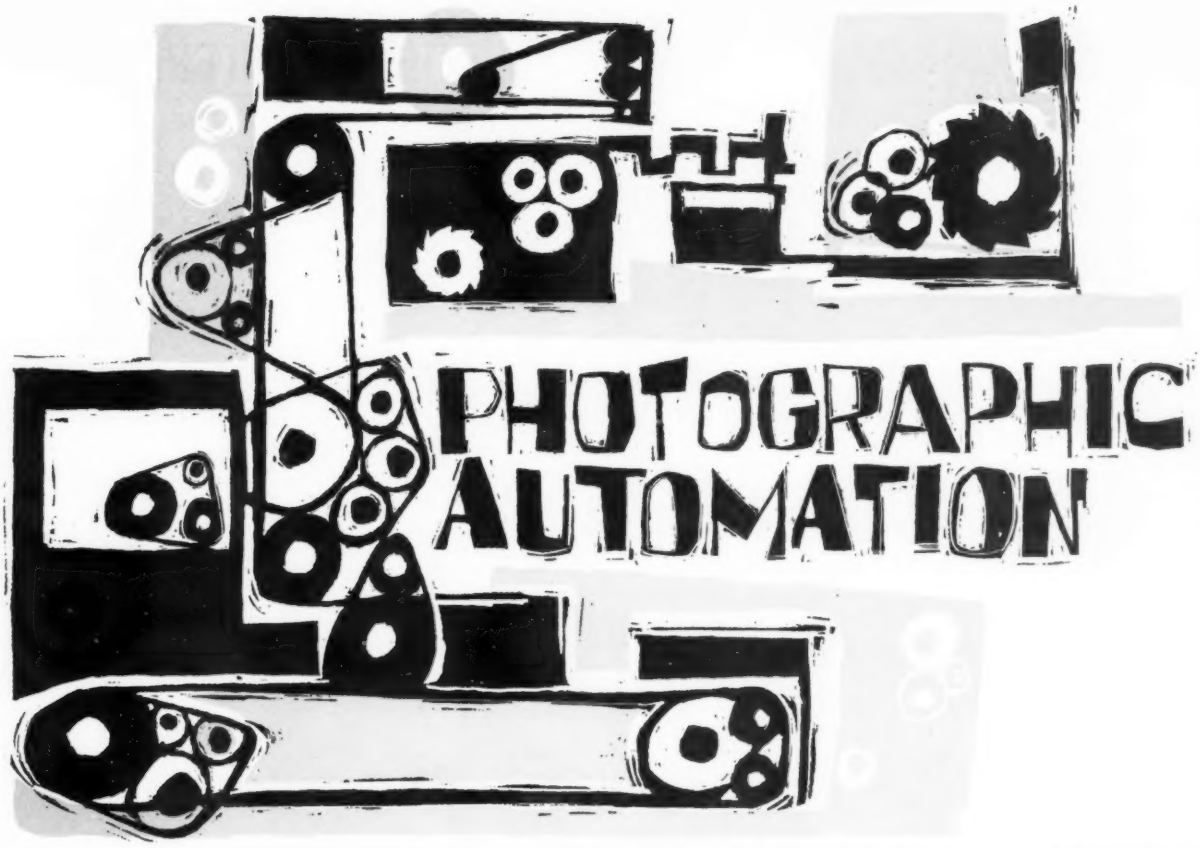
Dr. Mees dies

Dr. C. E. Kenneth Mees, a vice president and research director of the Eastman Kodak Co. died August 15 of a heart attack in his retirement home in Honolulu. He was 78 years old.

Dr. Mees directed Kodak research efforts from 1912 to 1955. Developmental work under his direction resulted in home movies, a steady march of improved black-and-white films, infra-red photography, Kodachrome and negative-positive color systems. He wrote some 150 scientific papers and several books, was responsible for *The Theory of the Photographic Process*, a compendium of scientific knowledge about photography. Dr. Mees received many scientific awards, including the Franklin Medal. He was awarded the Progress Medal of the Royal Photographic Society and the Scott Medal from the city of Philadelphia. He leaves a son, Graham, president of the Distillation Products Industries division of Eastman Kodak Co., and a daughter.

Reminder

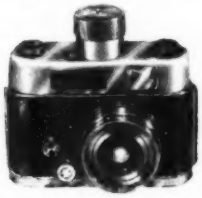
This is your column . . . why not take advantage of it. We are always anxious to hear from you. Send information to PMI, 33 West 60th St., New York 23, N.Y.—THE END



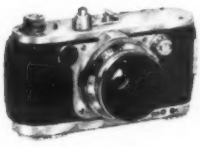
ROBOT 35mm CAMERA—NUCLEUS OF A COMPLETE ELECTRO-AUTOMATIC RECORDING SYSTEM

For the past 25 years, the ROBOT manufacturers have concentrated their efforts on the development of an entire system of precision AUTOMATIC recording equipment. Built around the 3 basic ROBOT AUTOMATIC 35mm cameras, according to the construction-unit principle, the ROBOT System can be easily adapted to any photographic registration problem.

ROBOT ROYAL S/Sa: 24x 36mm, 24x24mm or 18x24mm frames; with coupled rangefinder/viewfinder; automatic ONE-by-ONE shots or KINOGRAPHIC SEQUENCE for bursts of 5-6 frames per second. From $169.00.



ROBOT STAR II: 24x24mm frames; with lumiframe viewfinder; single motor for up to 20 exposures or double motor for up to 55 exposures *without rewinding*. From $109.00.



ROBOT RECORDER: 24x36mm, 24x24mm, 18x24mm or 6x24mm frames; without range/viewfinder. Optional: rewind knob, sequence release, reticle, reflex-system for double exposing second 8x8mm image. From $129.00.

ROBOT COMPLETE ELECTRO-AUTOMATIC RECORDING SYSTEM: ROBOT Royal or Recorder camera; 30 or 200 ft. magazines; electric booster motor; Kuli camera holder; electromagnetic remote release; interchangeable lenses, from 30mm up to 400mm; angle bracket; transformer-rectifier; timer for automatic release with intervals from ¼ sec. up to 24 hours.

Eliminating all elements of human error, the ROBOT AUTOMATICALLY records tens, even hundreds of thousands of pictures, thus saving invaluable time, labor and expense for — industry, science, medicine, education, as well as for the armed forces, government, police, journalists, professionals and amateurs.

karl heitz

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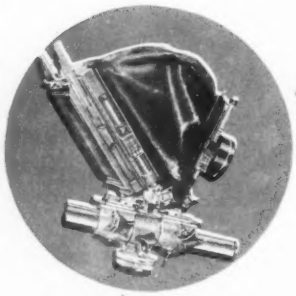
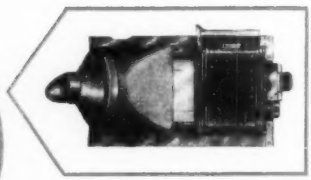
Split 6" and 12" optical bench, completely collapsible wide-angle bellows and flat frames allow use of the most extreme wide-angle lenses (4x5"—47mm; 5x7"—65mm; 8x10"—75mm), without recessed lensboards.



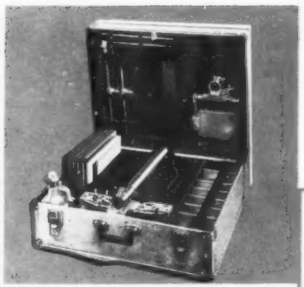
COMMERCIAL PHOTOGRAPHY

Coarse and micro-gear focusing, unlimited rise and fall, 90° tilts, 3" left/right shifts, 30° side swings, 360° swiveling of entire camera. All adjustments (with center marks, individual locks and leveling gauges) are on ONE side, easily accessible from behind groundglass.



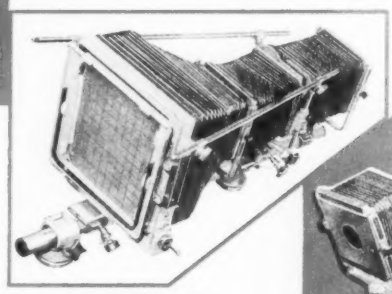
PORTRAITURE AND FASHION PHOTOGRAPHY

Fully interchangeable backs and bellows OR reducing adapters for 8x10", 5x7" and 4x5" (incl. Polaroid) PLUS one-stroke Rapid Adapter for 2¼x3¼" and 2¼x2¼".



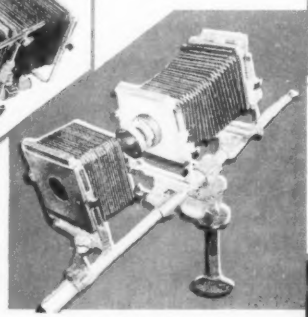
INDUSTRIAL PHOTOGRAPHY

SINAR is completely collapsible, lightweight, easily portable (carrying case), yet extremely precise, rigid, dust and humidity proof. Unlimited extension of optical bench and bellows, universal shutter, universal filter holder and lenshood for unlimited range of lenses from 47mm up to 800mm.



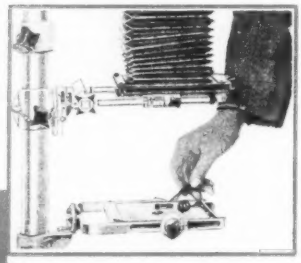
TEST SHOTS AND COLOR SEPARATION

Built-in registration pins, multicolor plate holders and stabilization rods adapt the SINAR 8x10" for color separation and process work. The Rapid Adapter, for 2¼x3¼" or 2¼x 2¼", has a film-flattening glass plate for small size color separation.



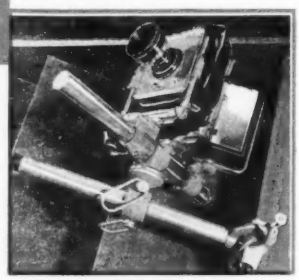
MULTIPLE EXPOSURES

Groundglass has ruled grid and center cross; auxiliary frame holds masks and is easily adjustable, while detachable mat box bellows is adjustable in any direction for photo montages and trick shots, even with color film.



COPYWORK—MACROPHOTOGRAPHY—PHOTOMICROGRAPHY

Built-in copy and close-up stand, with auxiliary frame or interchangeable back on optical bench, becoming a focusable object stage. Adapters for 35mm Single-lens Reflex cameras, microscopes, etc.



DIFFICULT CAMERA POSITIONS

All-purpose clamp and camera holder for attachment of SINAR to tables, ladders, fences, etc.; pan-tilt tripod head, with 9 braking surfaces for locking in any position; front surface mirror for focusing in cramped spaces.

SINAR

ONE VIEWCAMERA FOR:

ANY JOB—ANY FORMAT—ANY LENS—ANY ADJUSTMENT—
ANY SPECIAL APPLICATION—ANYWHERE

	STANDARD	EXPERT
4x5"	$369.00	$599.00
5x7"	$449.00	$699.00
8x10"	$629.00	$899.00

SCHNEIDER Angulon, Super-Angulon, Symmar, RODENSTOCK APO-RONAR, IMAGON and KERN APO-REPRO LENSES from 47mm - 800mm in SINAR lensboards.

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	GARDEN & WILLIAMS	601 N. La Brea Ave., Hollywood 36
	GORDON ENTERPRISES	5362 N. Cahuenga Blvd., N. Hollywood
	BROOKS CAMERA	45 Kearny, San Francisco
COLORADO	J. A. OSSEN CO.	2144 Welton St., Denver
DISTRICT OF COLUMBIA	BAKER'S PHOTO SUPPLY	4611 Wisconsin Ave., NW, Washington
MICHIGAN	GARRICK'S PHOTO SUPPLY	3166 Cass Ave., Detroit
MISSOURI	STANLEY PHOTO	106 N. Broadway, St. Louis
MINNESOTA	CENTURY CAMERA SHOP	26 So. 7th St., Minneapolis
NEW YORK	ROYALTONE CAMERA	245 7th Ave., New York 1
PENNSYLVANIA	FOTOMART, INC.	8 S. Sixth St., Philadelphia 6
TEXAS	PATTERSON PHOTO SUPPLIES	113 E. Main, El Paso

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Edward R. Farber

ELECTRONIC FLASH

Assorted thoughts, applications and electronic flash miscellany

Electronic flash is being used in experiments to amplify radiation in the optical frequencies. A device called a *LASER* (Light Amplification by Stimulated Emission of Radiation) contains an artificial ruby excited by the 700 Angstrom band (in the green light region) of the flashtube.

An output pulse of energy appears in the 6,943 A line, (red light) and less than an Angstrom bandwidth. This device may make possible radar units which provide an actual picture of a target.

In practice, the synthetic ruby rod sits in the helix of a flashtube resembling an FT503 quartz type.

Reading a book on soap bubbles published over fifty years ago, I was surprised to find that electric flash was resorted to extensively to study droplets. Under a paragraph titled "Photographs of Water-jets" was the following suggestion. "These are easily taken by the method described by Mr. Chichester Bell. The flash of light is produced by the short spark from a few Leyden-jars. The fountain or jet should be 5 or 6 ft. away from the spark and the photographic plate should be held as close to the stream of water as is possible without touching. The shadow is then so definite that the photograph may be examined with a powerful lens, and will still appear sharp."

This book originally published in England and written by C. V. Boys is excellent reading for anyone whose work requires the photography of liquids, sprays or bubbles, not because of the photographic information of which there is little, but because so many problems which plague the photographer are explained in simple language and drawings. Boys tells how Lord Raleigh photographed a breaking soap film by dropping a shot through it and photographing it 1/1000 sec. later by dropping a second shot the same instant, which passed between the knobs on the charged Leyden jar. By having the second shot fall a little farther, different phases of the films breaking could be pictured.

Boys then made similar pictures, but punctured the soap film with a weak spark between two needles, and photographed it an instant later with a second spark. This method gave him a spot or point in the photo showing where the puncture of the film occurred in the first place. He timed his sparks with a switch made of a "mousetrap-like spring."

The book has been reprinted by Dover Publications, New York, N.Y. *Soap Bubbles and the Forces Which Mould Them*, 95¢ paper bound.

In the last few weeks, we have had numerous calls from friends whose photoelectric slaves were not operating. They didn't follow through on summer maintainance. PE tube circuits can be easily upset by high humidity. Many times slave systems are completely separate units and are forgotten when cleaning and siliconing operations are performed on the unit itself.

An electronic flash miscellany

Recently patent No. 2, 919, 383 on "Flash Apparatus and Method" was issued to Harold Edgerton. It covers a flash device consisting of two heavy electrodes inserted in a close fitting quartz sleeve. The electrodes can be moved to change the size of the gap. The tube is of the self-ionizing type and could be used in air or other gases. In order to aid the breakdown of the gap when the electrodes are very close, the quartz is heated externally, causing it to become slightly conductive, thus permitting the discharge to begin. The device has been used to produce trains of light pulses from the 60-cycle power line.

The unusual values of the various fuses found in electronic flash units makes them almost impossible to find in local stocks. Best kind of service on items like this seems to be from mail order houses such as

(*continued on page 22*)

Here's Portability *plus* Power!

ascorlight®
A423 200 Watt-Second
TRANSISTORIZED
ELECTRONIC FLASH

- 7000 BCPS*/50° (Kodachrome guide no. 70)
- 7½ lb. shoulder-weight with "D" cells
- 8 second recycling
- Choice of operation: "D"-cells, AC or rechargeable nickel cadmium battery (140 flashes per charge, standby time up to 9 hours per charge)
- Push-button controls

...and economy in portraiture!

HEAVY-DUTY, 4-LIGHT
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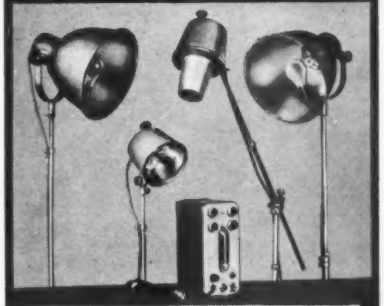
AC ELECTRONIC FLASH



- 4 lights — two 10" main lights, hair-light and backlight (100-100-50-50 watt-sec.)
- Excellent with use of Ektacolor type S
- 4000 BCPS*/50° (Ektacolor S guide no. 60)
- 8 second recycling
- Power supply weight, 12¼ lbs.

ASCORLIGHT A425 and A426 SCHOOL COLOR UNITS: heavy-duty, economy 4-light units which recharge in only 3 seconds.

*Beam Candle Power Seconds

Write for complete technical data

American Speedlight Corporation
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Get more information. Circle 401, page 77

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• MAKES SILK SCREEN NEGATIVES!

A model for every recording need! Prices from $975.00

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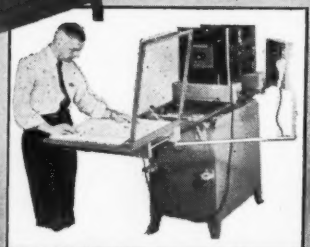
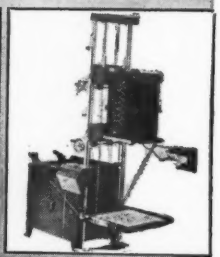
COPYING, ENLARGING and REDUCING CAMERA

It's superb! Self contained! Unlimited Range . . . Interchangeable Lenses and Backs . . . Front or Rear Lighting . . . Independent Controls . . . Effortless Image Focusing! Fully Guaranteed! In Use by Professional & Gov't. Agencies.



Easy Loading Hinged Copy Frame



90° Vertical Operation

Write for Free 132 pg. Photo Tools Catalog PMI-9-60

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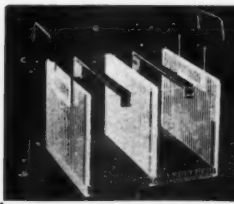
FOR PICTURES THAT ARE CLEAN! CLEAN! **CLEAN!**

PROCESS YOUR FILM WITH A



DANDY DUNKER TM

1. The Dandy Dunker is a film processing basket which obsolesces all film hangers, including our own. Film sheets are firmly secured on all four sides without covering or fouling one particle of picture surface. Dandy Dunker's floor is constructed of glass fiber honeycomb which maintains fully free and even movement of photochemicals, thus eliminating film streaking and mottling. THIS IS QUALITY!

ALL THIS AND HEAVEN TOO!

2. Only 4 separate parts to process up to 48 sheets simultaneously!
3. Re-exposure of color transparencies may be done safely, simultaneously for 48 sheets without removing sheets from the Dandy Dunker!
4. Easier loading, saves up to 9 minutes in loading 48 sheets!
5. Saves up to 12 minutes in unloading, since it takes only 15 seconds to unload 48 sheets!
6. "C" model is the only single framework which may be used for either 4x5 or 5x7 film!
7. 5x7 frames as low as 83c each; 4x5 frames as low as 77c each!

MODEL "A"	3½ GAL. TANK	48 SHEETS 5x7	$39.85
MODEL "B"	3½ GAL. TANK	48 SHEETS 4x5	35.85
MODEL "C"	KODAK 5x7 TANK	12 SHEETS 5x7 / 20 SHEETS 4x5	26.85

TOMORROW inc. TUCSON, ARIZONA

Get more information. Circle 494, page 77

ELECTRONIC FLASH

(*continued from page 21*)

Allied Radio, 100 Northwestern Ave., Chicago, Ill. and Lafayette Radio, 165-08 Liberty Ave., Jamaica, N. Y. Doubtless there are others. The prices are reasonable and it would pay to have some on hand. Too often a substitute has resulted in expensive repairs.

It is important to remember that a one ampere fuse and a one ampere "SloBlo" fuse or "Fusetron" are not the same things. Most flash units use the latter type which permit about a 10-sec. overload before failing. This permits an intermittent heavy inrush of current into the capacitor but in case of a continued short the fuse would fail.

Replacement of a delay-type fuse with a standard one of the same size will usually result in failure of the fuse after the first flash or so. If a standard type fuse is used that is large enough to permit the inrush to the capacitor without fuse failure, it probably will not fail when a short circuit occurs, and the unit will be damaged.

Sometimes fuses just get tired and fail for no obvious reason at all, except that they were weak mechanically. If no obvious reason for failure exists, it is worth the price of a fuse just to try a new one, and save a service call.

Brochure on Batteries

A new 10-page booklet on Silvercel batteries, a compact rechargeable silver zinc-type is available from Yardney Electric Corp., 40-50 Leonard St., New York, N.Y. Recommended for those who want to build small, lightweight portables. — THE END

WHAT?

What's in the PMI DIRECTORY? Names and addresses of manufacturers and services . . . products and equipment . . . trade names . . . all types of services . . . the famous PMI diagrams, charts, graphs . . . and other helpful and useful information. The PMI DIRECTORY will be published in September, 1960. You can get it absolutely FREE by subscribing now to PMI at only $5.00 per year, 2 years for $9.00, 3 years for $12.00.

New Kodak Ektalith Method saves you time, space and equipment costs in office offset duplicating

This compact, table-top installation, teamed with office copy camera and duplicator, lets you make either high-quality *photo offset masters* or *direct paper copies* of the widest variety of documents—*enlarged*, *reduced*, or *same size*. Only 3 simple steps—expose, process, transfer. In less than 2 minutes' time, you're ready with master or copies! Job's as clean as it is easy, can be handled by anyone in the office with a minimum of training.

Kodak Ektalith Loader-Processor, shown to left, permits entire operation to be carried out in *room light*. Together with companion Kodak Ektalith Copy Unit it costs you only $788.50.

Now you can reproduce practically anything printed, typed, written or drawn—quickly, conveniently, and at low cost. You can copy all line work and a variety of halftones—all kinds of pen, pencil, or crayon writing in almost any color. Solid images are reproduced next to fine detail without mottling. Masters require little or no clean-up time, are easily corrected prior to running.

Free booklet gives complete details on Kodak Ektalith Method and equipment for both room light or darkroom installation. Call your Kodak Ektalith dealer or write Eastman Kodak Company, Graphic Reproduction Division, Rochester 4, New York.

Price is list and subject to change

KODAK **Ektalith** METHOD ... *puts you ahead in offset*

Kodak TRADE MARK

imitation is the sincerest form of flattery

and flattered we are that other laboratories sometimes use our registered trademark

color-correct®

is an industry standard to mean the finest quality in color duplicating.

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Get more information. Circle 416, page 77

Arnold Eagle

INDUSTRIAL MOTION PICTURES

Technical problems and solutions in the techniques of animation

In my last column, inspired by the Florman and Babb animation seminar held in New York in June, I discussed some simple animation techniques which could be employed by the average industrial film department which does not possess highly specialized animation equipment or trained animators. In this column I would like to discuss the more advanced animation techniques. Although no one expects the in-plant film maker to complete this type of film by himself, it is important that those connected with film making are acquainted with these techniques. Then, when an animation problem arises which requires the services of one of the many animation studios, the film maker will have some idea of what he wants and some knowledge of the equipment and work involved.

The fundamental technique in animation is cartoon cel animation. In this technique every change of movement in the frame is a slightly changed drawing. Thus, if the movement of a figure takes one second then, theoretically, 24 drawings in progression are needed—one for each of the 24 frames of the film. The drawings are placed in registration on the animation compound (copy table) and exposed single frame using camera stop motion. The usual practice of animators is to make two exposures of each drawing, thereby cutting in half the number of drawings needed. If the movement is slow, three or even four exposures of each cel may be made. By drawing the moving figure on a cel (a thin clear plastic sheet 1/5000 in. thick) and overlaying it on the background which usually does not change with each frame, you cut down on the number of background drawings required.

The cels have registration holes punched in them so that they will fit accurately on pegs which are part of the standard equipment of the compound. Of course, the drawing tables must have the same pegs. The principle of changing only for the moving parts of a drawing will, in many cases, require three, four or even more cels. For instance, the body on a second cel may be left unchanged, with only the arms and legs showing movement.

In most studios, the art work is done in separate stages by different specialists. Before any actual animation is begun, there is a great deal of preparation and planning. The story line, style and cartoon characters are devised and designed. Then the chief animator proceeds with the story board using about 30 or 40 rough drawings per screen minute. Simultaneously the sound track is prepared. Music, sound effects and dialog are recorded, timed and charted. Then the chief animator creates the work book, wherein each frame is analyzed and directions given on technique, timing, etc., to the other animating artists and to the cameraman. Only then does the animator proceed to make the key rough drawings, skipping four or five frames after each drawing. Then the assistant animator, or the in-between animator, takes over filling in the in-between roughs. These are usually done on tracing paper. Next comes the inking. This work is usually done by girls who trace the rough drawing on the cel with a pen, in clear lines, or with a fine brush. Then the inked cels go to the opaquer who fills in on the other side of the cel (so that the black lines remain) with opaque colors, or if for television, with different shades of grey.

When using multi-layer cels, a new problem arises. Although the cel is only 1/5,000 in. thick, it is enough to change the shade of the underlying drawing noticeably. To correct this, the top layer drawing must be a shade darker than the drawing under it. When four or five cels are used in register, this can be quite a problem.

(*continued on page* 26)

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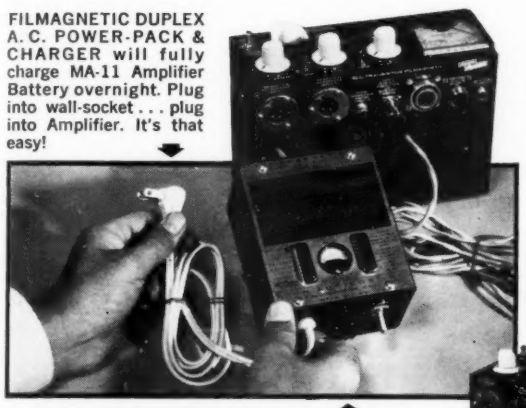

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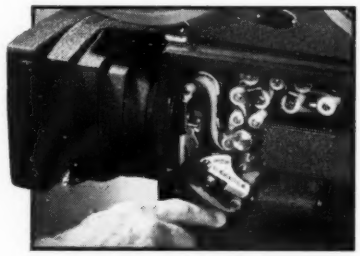

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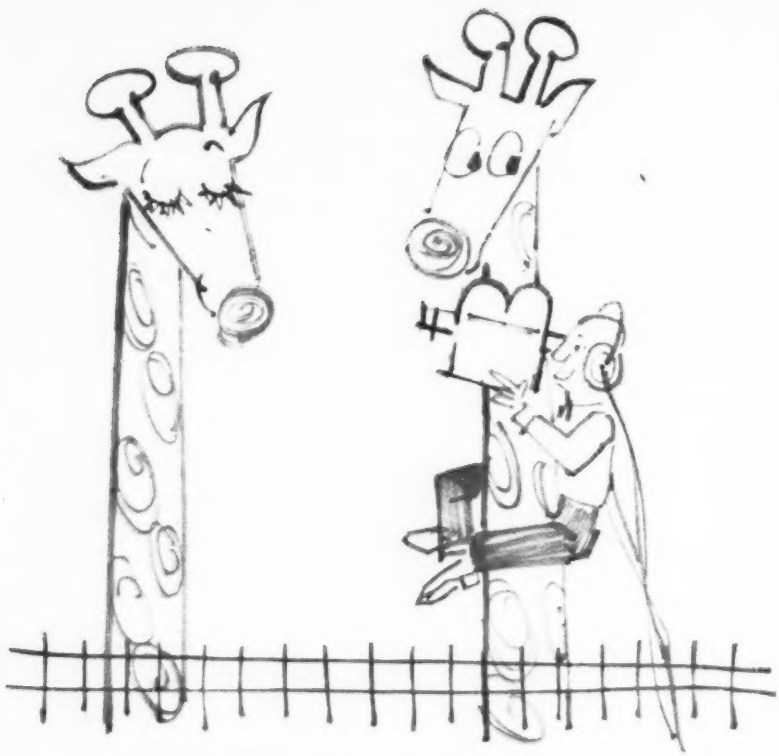

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IND. MOTION PICTURES

(*continued from page* 24)

The backgrounds are prepared by special departments. They can be quite ingenious. For instance, in some television commercials real material may be used for drapes; or photostats may be utilized where real material may be reduced and used as a dress in the background, or as wallpaper. It is impossible in an article such as this to give even a sketchy outline of the many and varied problems connected with cel animation. There are the complex mathematics needed to figure out the rate of movement of the figures or the rate of the zooming of the camera. Mathematics must be used in opticals like fades and dissolves to decide how much to reduce the exposure for each frame. (In animation the opticals are always done in the camera.) Fairing has its own mathematics. (You may remember from my last column that fairing is the momentum and tapering off of movement.) Strobe effect must be avoided. (Strobe effect occurs when an object moves across the screen. If the figures don't overlap there is a shattering or jittery effect.) Drawings, unlike real live actions, have no blur.

Cel animation must be done on an animation stand and a compound with peg tracks for registration. Fully equipped animation stands are expensive; from $2000 to $40,000. There are several firms in this field: the Acme Co. of California; Oxberry of New York; Bowlder of California; S.O.S. in New York; Saltzman in New York; the Portman stand in New York (similar to the Oxberry stand) and the Florman and Babb Triplex stand which I described last month. Incidentally, the Florman and Babb stand was designed and manufactured by Warren C. Portman, who makes the Portman stand. Portman contributed a great deal to the success of the Florman and Babb Animation Seminar as he was one of the organizers and main lecturers there.

Simple cel animation can be accomplished on a basic stand consisting of a zoom post with a camera carriage and a peg track table. But for more elaborate animation and for speeding up the work, there are gadgets and equipment which are very useful—and expensive! There are specially-built animation cameras that take 16 and 35mm film. These have extra magazines for Bipack work. Bipack is very popular these days in TV commercials, combining live action with live back-

grounds. It replaces costly background projection. One of the packs in the camera carries an exposed and developed roll of film; the other, unexposed raw stock. The camera works like a contact printer, doing work usually done on an optical printer.

There are items like variable electric motor zooms, automatic follow focus, compound camera carriage which allows off-center zooms, peg track rotary table compound top with gimbal mounted platten (clear white plate glass to keep the art work flat), two or three floating peg tracks for moving the art work while the background is held steady; underneath light boxes for transparencies, rotoscope used in the animation camera to project an image to the table, still and movie projectors for background projection and various other costly gadgets. When you realize the amount of skill, training, equipment, personnel and time involved in the production of a 1-min. animation film, you will not be surprised at its cost.

Other types of animation involve three-dimensional animation such as puppets. These do not require animation stands. Puppets are created in various forms and materials, but the most common is still the figure carved from wood with movable limbs and interchangeable heads (for different expressions). You also see puppets made from various flexible materials; flexible skeletons covered with sponge rubber and numerous plastic and putty forms. It is a difficult and highly individualistic art, usually more expensive, and generally less successful than drawing and cel animation.

Three-dimensional animation involves any object or product that is animated with stop motion photography. This technique is especially useful for industrial film makers. I did say that for this type of animation an animation stand is not required, but with the Florman and Babb Triplex stand the zoom post can be placed at any angle and the compound becomes a product stage. The subject can be turned around on the rotary compound and the camera can zoom in and out. Then, by lifting the zoom post to a different angle, a crane effect can be achieved. Usually it is the camera that stands still while the objects to be animated are turned and moved. A most important point is that these movements should be plotted out in advance. As in cartoon story boards, to insure that the movements are even and smooth. Don't forget the fairing.

(*continued on page* 60)

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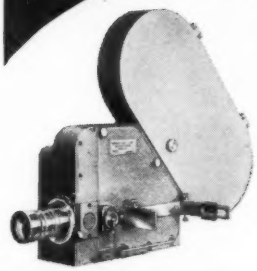

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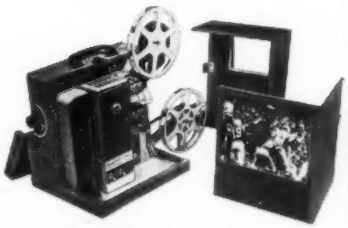

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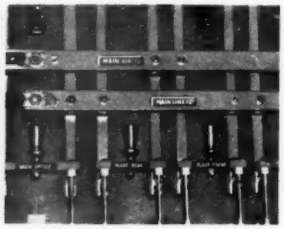

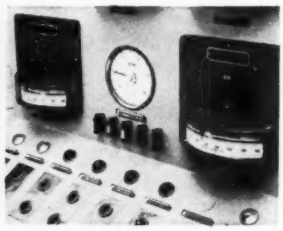

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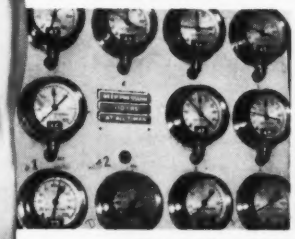

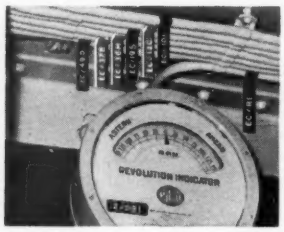

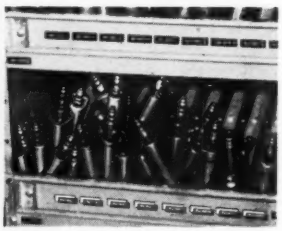

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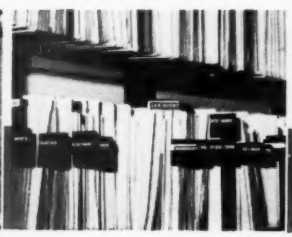

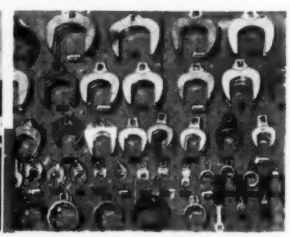

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AN EDITORIAL

DEVELOPMENT BY INSPECTION

Whether it's a cornucopia or a bottomless pit, there's more to know in photography than any one man could possibly learn in a lifetime. In-plant men, faced as they are with so many divergent demands on their talents, are often haunted with this thought. They feel they could do things a lot better if they could have just a brief respite to study, to think, to organize some of this information for the benefit of their unit. One extremely well-run department we've heard of recognized this problem and came up with a counterattack. The photo department manager tore the focusing cloth from a senior staff man, sat him down at a desk and assigned him, in effect, to study the department. ■ In analyzing a week's output of prints he noticed what a lot of copy work the department did. His taste informed him that the quality of the copies was not up to the standard of the department's ordinary prints. He got samples of some of the new copy films, tested them out, developed a procedure for their use, trained the men who handle the copy work in the new method and set a new standard for copies that's one of the best in the country. ■ Of course there are many other possible functions of such a job. Others include: developing new services for the company; working out ways to effect ideas and suggestions brought up by employees and outsiders; testing applicable new equipment; trouble shooting; helping new men sharpen up their techniques; taking short courses; visiting other photo units; attacking ordering, stocking and paper work problems. In short, actually doing all those things that everybody thinks about —and puts off. ■ As you have guessed the exemplary department mentioned is a fairly large one—large enough so that the assignment can be rotated among several highly-competent men. But recently we heard of another case, this one in a department of three men. They put the same idea into effect by freeing one man one day per week for study. We hope it's a trend.

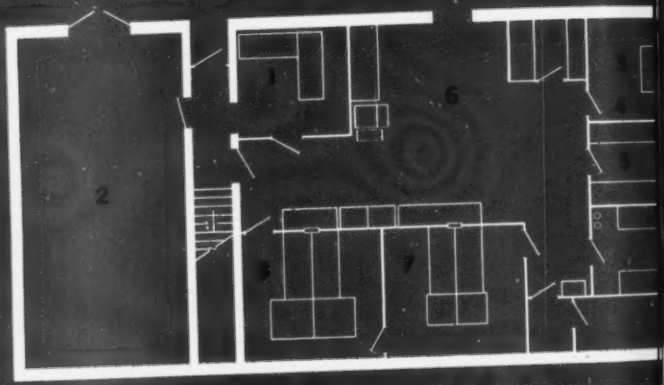
The Editors

ALLIS-CHALMERS M

1 Telephone calls keep Clarence Hansen, Supervisor of the Photo Lab, busy to the tune of one every three minutes. Betty Sweeney checks orders.

2 Studio provides ample space for movie set for filming of scenes for sales promotion film. Don Ackerman, cameraman, sets his sights on Russ Einwalter. Ed de Vilbiss stands by.

6 In the Enlarging room Dan Plichta, at the Automega D-3, takes a reading on the Etwood Photric-Timer to make sure of proper print exposures.



Lab is air-conditioned with 45-ton unit. Each room has temp control. Twenty-ft. Studio is at top.

7 Contact Printing room is staffed by John Butcher and Genevieve Diercksmeir. They turned out over 250,000 prints in last year's print explosion.

6 Karen Laughner (left) and Sharon Case handle finishing room chores. Pass-through chutes channel new prints into stainless steel sinks for washing, after hypo-eliminator

S MFG. CO.

3 Dan Plicman focuses on art work in Slide Production room. All slides are shot in color except for detailed drawings made on process film.

4 George Marshall checks timer setting in Color Process darkroom which doubles in brass until the water system is hooked up to city supply.

5 Black-and-White Processing darkroom is another haunt of staffer George Marshall, here inspecting 2¼ x 2¼ roll film just developed.

A-C's photo group knew what they wanted in a new photo lab. Last year their ship came in: a lab that fit the job to a T with elbow room for five years' expansion. At the same time a modern accounting system levied print charges directly on the customer. In theory this would cut down the orders. Nothing of the sort. The five-year space lead is all gone, and the photo boss sees no limit to future photo work: "We have a print explosion!"

"We moved into this new layout last summer; and right now, just about a year later, our backs are almost against the wall." With these words, Clarence Hansen, supervisor of the photo lab section at Allis-Chalmers West Allis (Wis.) plant, more or less formulated his own application of Parkinson's Law. In the short space of 365 days the workload-output of the new lab had grown to a point originally estimated to be about five years off.

A tiled, stainless steel efficiency unit decorated in tranquil yellow and grey, the new lab is outfitted with equipment that would warm the heart of any veteran industrial photographer. Actually, the lab is a bi-level installation with photographic processing concentrated on the first floor while the second floor is devoted to the graphic arts group. Juxtaposed to both is a studio 20 ft. high and extending the full width of the lab. Roughly, there are about 4,000 sq. ft. of floor space utilized by a staff of 13 and their multifarious equipment.

Focal point of the lab's operations is Hansen's office, where he schedules daily activities of both photo and graphic arts groups, assisted by his secretary, Betty Sweeney. Handling an average of 90 requisitions each day, Betty also keeps in close contact with staff members by means of an intercom system hooked into all of the various lab areas.

The idea of the new lab took birth several years ago, when the company embarked on an extensive remodeling and modernization of its main office building in West Allis. The former lab facilities lay right in the path of this program, providing an excellent opportunity to lay plans for remodeling and modernization of this facility. For months be-

ALLIS-CHALMERS *(continued)*

fore last year's move, Hansen conferred with company officials, architects, and other in-plant men to evolve the perfect darkroom for their needs. Blueprints from several other major companies were studied for any suggestions and additions they might offer. Finally, the plans in their present form were submitted and approved. So good were the plans that in the six months of operation only a few minor difficulties have turned up.

Completion of the new lab resulted, moreover, in an organizational change. Previously, the only major photo lab installation at the West Allis plant was this facility under Hansen which included a staff of four photographers. Mike Durante, Jerry Gosseck, Frank Hart, and Hal Shrode handled all assignments for the Industries Group advertising department, covering principally the heavy capital equipment manufacturing carried on at the West Allis plant; they also made several field trips each year during the summer months, taking installation pictures at various spots across the country. But after the move to the new photo lab, this staff of industrial photographers remained under sales promotion, Industries Group, while Hansen's crew shifted to Office Services as a part of the duplicating and circulation department under Manager John Gumtz.

Industries Group sales promotion also has two movie and audio-visual men, Henry Serdy and Bill Jahrman. In addition, Tractor Group sales promotion has its own staff of still and movie photographers, including supervisor Dick Piasecki and staffers Don Ackerman, Russ Einwalter, Darrold Pries, and Herbie Zeck. This section uses commercial processors. This is particularly true in the movie field, both in Industries and Tractor groups. Durante and company, however, still stick to the

On hand for this family portrait were eight of Allis-Chalmers' West Allis Works photographers. From left: Don Ackerman, Clarence Hansen, Henry Serdy, Russ Einwalter and Mike Durante *(on ladder)*, Bill Jahrman, George Marshall and Dick Piaseki

old routine, more or less. Each man coming in from an assignment sees his own job through at least to the developing of negatives. Cameramen also load their own film holders.

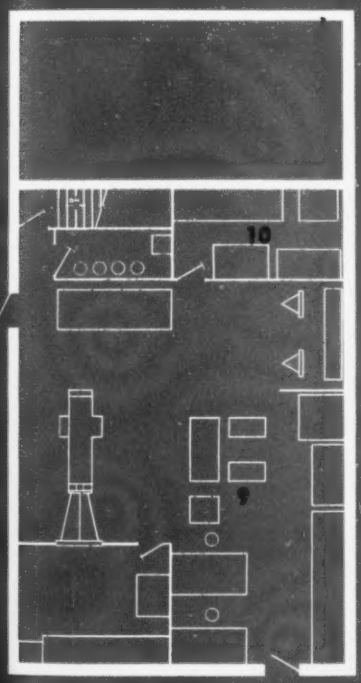
A tour of inspection of the new lab would take us from Hansen's office to our first stop, the Film Loading room. Next, would be the Slide room with its own unique set-up. Here George Marshall shoots all slides in color.

"The majority of material is in color anyway," says Hansen, "and since it doesn't make any difference for the few black-and-white jobs, we save ourselves the trouble of changing film for these few occasions." The only exception is the case of detailed drawings. Cost of slides made here rather than outside was cut from $3.75 to $1.25.

Next stop—the Color Developing room, which will require 1,000 gals. of water per day when it is in operation. "We're now in the process of putting in city of Milwaukee water," says Hansen, "because our own is unsatisfactory for color work."

Black-and-white Developing room is our next stop, where George Marshall puts on his second hat and processes an average of 100 sheets of film each day. Here we should note that each room has its own temperature control while humidity is controlled throughout the entire lab: both accomplished with a 45-ton capacity air conditioning unit. All water is also temperature controlled.

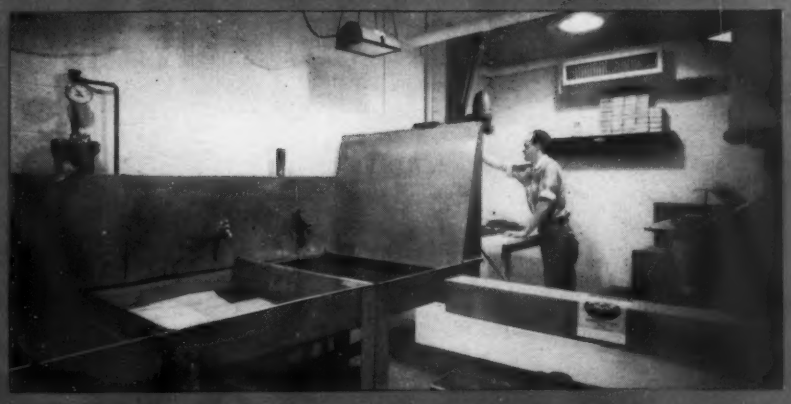
Just outside the film developing room is the negative dryer with a capacity of 100 sheets of 8 x 10 film every 15 minutes. Just next to the dryer is the door to the Contact Printing room: overhead illumination from golden fluorescent tubes casts a soft yellow light while giant sized safelights have eliminated the need for space-consuming labyrinthine construction. The same lighting is used outside the Enlarging room.



Graphic arts, microfilm are on the top at Allis-Chalmers

A-C's West Allis photo group splits 4000 sq. ft. on two floors (studio is two story room with 20-ft. ceiling). Upper half houses repro, diagrammed above. Printing presses are in another department.

9 Graphic arts staff runs Robertson (right) vacuum frame (left) washoff sink (background). Staffers are Holyoke, Meier, Mindeman and Praxel.



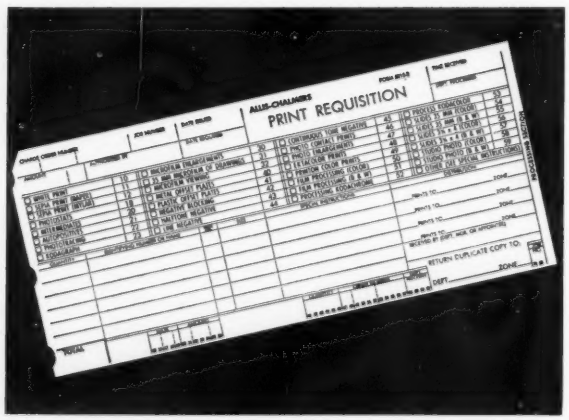
10 Tom O'Brien runs enlarger and Copy-All unit (right) in microfilm enlarging room. That room next door is the top half of the two-story studio.

Two contact printers, handled by Genevieve Diercksmeier and John Butcher, turn out close to 500 prints every working day. Pass-through chutes guide the prints to wash sinks in the Finish Processing room (the same technique is used by the Enlarging room, too).

For print orders of 100 or more, Hansen has found that commercial print houses with their roll paper and automatic printers can deliver the work cheaper and faster. This arrangement arises only once or twice a month at the most and works out satisfactorily for all parties concerned.

Work in the Enlarging room centers around a 4 x 5 Automega D-3. Here Danny Plichta utilizing an Elwood Photric-timer turns out excellent enlargements from 35mm, 2¼ x 2¼ and 4 x 5 negatives. The Saltzman 8 x 10 unit with its voltage regulator-timer is also on the firing line, as is a Welch Densichron for color printing. Developers used include Dektol for prints, DK50 for sheet film and UFG for roll film.

With the prints processed, the final steps of washing, drying and ironing are handled by two more staff assistants, Sharon Case and Karen Laughner. All that's left on the first floor is the Studio, but that's a full two stories high with double doors on the west end and more than 6 ft. wide, ample for just about any 7-ft. high behemoth scheduled for its portrait here. Backdrop arrangements on the east wall of the studio include three rolls of seamless paper which are chain-operated rather than crank, while five more rolls of other colors are racked up on the south wall. Up above are seven banks of five 3200K lights each, plus a suitable array of mobile spots on the floor. Besides the usual product shots, a steady stream of identification photos and portraits keeps the studio in almost constant use by the A-C photo staff.



New system bills work directly to originating department. But when people know what it costs, A-C finds orders climb and climb. EAM card *(above)* mechanizes bookkeeping.

On the second floor, the Graphic Arts group handles its work in the Microfilm darkroom, Phototracing room, and Process Camera darkroom. Five staffers turn out a steady stream of photographic reproductions: Tom O'Brien in microfilming; Yvonne Holyoke and Evelyn Meier in phototracing; Don Mindenman, Louis Schulz and Jon Praxel in process and stripping work. Dominating the scene is the 4 x 4 Robertson reproduction camera for line, halftone, and continuous tone reproduction: unbelievable as it may seem, the boys consistently turn out copy negatives that rival the originals in clarity and definition.

An innovation in the handling of offset masters for 8½ x 11 short run jobs shaves time and costs to the bone (see *Fast Work on Short Runs*, PMI, June, 1960, p. 48). It is applied to typed data and most standard sizes of engineering drawings. By setting up reduction standards and calibrating the copy board and camera back, the cameraman is able to place his image properly centered on his negative material. Cleanliness and a paper negative practically eliminate opaquing. Because the negative is just the right size to cover the offset master, stripping is also eliminated. The negatives and offset masters are ganged on an oversize contact frame which knocks out a morning's work in one shot. Furthermore, the desensitizing of the masters is eliminated because they're protected from light.

Here, too, is the Chemical Mixing room. "We mix our shortstop upstairs in a separate room to avoid having bottles of acetic acid standing around," Hansen remarks, "as well as our developers: gravity feed to the developing rooms keeps them supplied. One accidentally broken bottle of acetic acid can do a lot of damage in a lab. Safety is as important as quality here."

Color scheme of the two walls next to the Robertson has been changed from yellow to grey to maintain high quality in color work.

Other highlights in this picture include a drawing rejuvenation process that cuts costs just about in half. In addition, the lab is now producing templates for the Control Department to aid in the assembling of equipment. Further economy is achieved by using paper negatives rather than film.

Acceptance of the lab has been overwhelming —literally. Under the lab's new accounting system, each department is charged for the print services it requests. The assumption was that work requests would drop in the face of these charges but they keep coming at an increasing rate. This tribute to photography at Allis-Chalmers is greeted with mixed feelings.

"Talk of a population explosion," Hansen exclaims, "we have a print explosion!"—THE END

MEMO ON:

123 HOW MANY PHOTO SECTIONS?

Photo managers disagree on an optimum number, but there's a slight edge for one, with specialized branches

Somehow, photo sections are never really planned. Like Topsy, they just grow, getting born when somebody convinces management that there is enough picture taking to keep a man busy full time. The result is that photo sections rarely exist as such. Usually, they belong to the department which did the selling. Quite often, there are several photo sections, one for each department which demonstrates its need for photographic service.

With the growth of photography and the development of highly-specialized photographic applications, the question of control arises. Who in a company will control photo services? Who will decide what photo services are necessary?

The position of the photo section today is a shifting one. Until a few years ago, only the very largest companies had full-scale photo departments. Most had photographers either hired by, or attached to, departments like engineering, public relations, advertising, research, personnel. This was fine when only one type of photography was needed. An example of this is the situation at a large drug company where the photo department, a small one, is assigned to research. Other photo needs are taken care of by outside photographers. Public relations, for example, has a firm which it calls for coverage of various plant functions.

Until recently, one large photo installation was split between public relations and engineering. Originally, there were ample grounds for the separation; the type of work was different. However, as the sections grew, the inevitable overlapping took place until both sections competed within the firm for work. Recently, both were merged into one section to handle all company photographic business.

There are almost as many opinions on the proper number of photo sections as there are photo sections. As with most arguments, there is a certain amount of truth to each side.

Advocates of the one big (or sometimes one small) section claim that shared facilities make the photo section cheaper to maintain. It is silly, they argue, for a company to maintain two labs and dupilicate facilities for two sections. Also, it is easier to plan work loads, avoiding situations where one section is so busy it has to hire extra people while another is slow and has to let some men go. Not a minor factor is the empire building; the more people a supervisor handles, the bigger his pay and the higher his rank. By combining sections, room is made for one super-supervisor plus the former plain supervisors.

Opponents of the one-big-section approach argue that the highly specialized jobs done by many in-plant cameramen require a specialist, not a general cameraman. This specialist is apt to have closer ties with the people he services than with another cameraman doing entirely different work. There are firms where the engineering photographers are more engineer than photographer. Then too, even if the work is not so highly specialized, a man working in a special department will get to know the needs of the department better and provide more "involved" photographs: he will be a participant, not a spectator.

The current line of demarcation now seems to be between photographers who communicate (such as advertising and public relations) and those who transmit data (engineering, research, instrumentation, etc.). This is a reflection of the increased part photography plays in industry today. Where all that was needed was a man who could handle a camera, it did not make much difference who had control of the body. Where the cameraman becomes an important part of the production team, however, who he is and where he is becomes important. A public relations photographer might be the most creative genius in the world but if he hasn't the temperament for photomicrography, he would be useless in a research project, for instance.

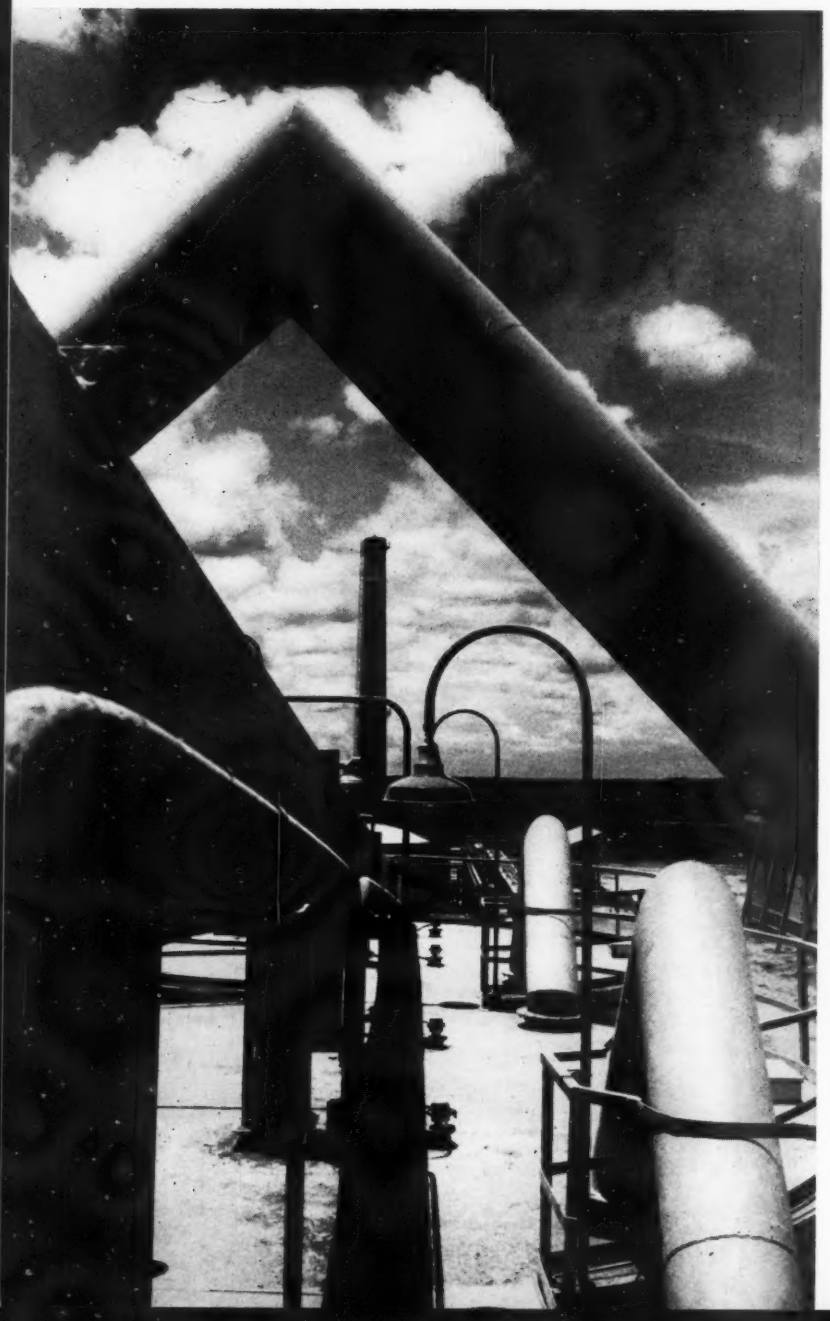
The answer may be along the lines established in a large oil company. The photo section was placed under general administration, reflecting the company-wide scope of photo services.

This problem, however, reflects a more basic problem, namely, that of the photographer's position in industry. In some cases, notably in the newer industries such as aircraft and electronics, photography is considered an integral part of the firm. The photo department not only produces photo service but

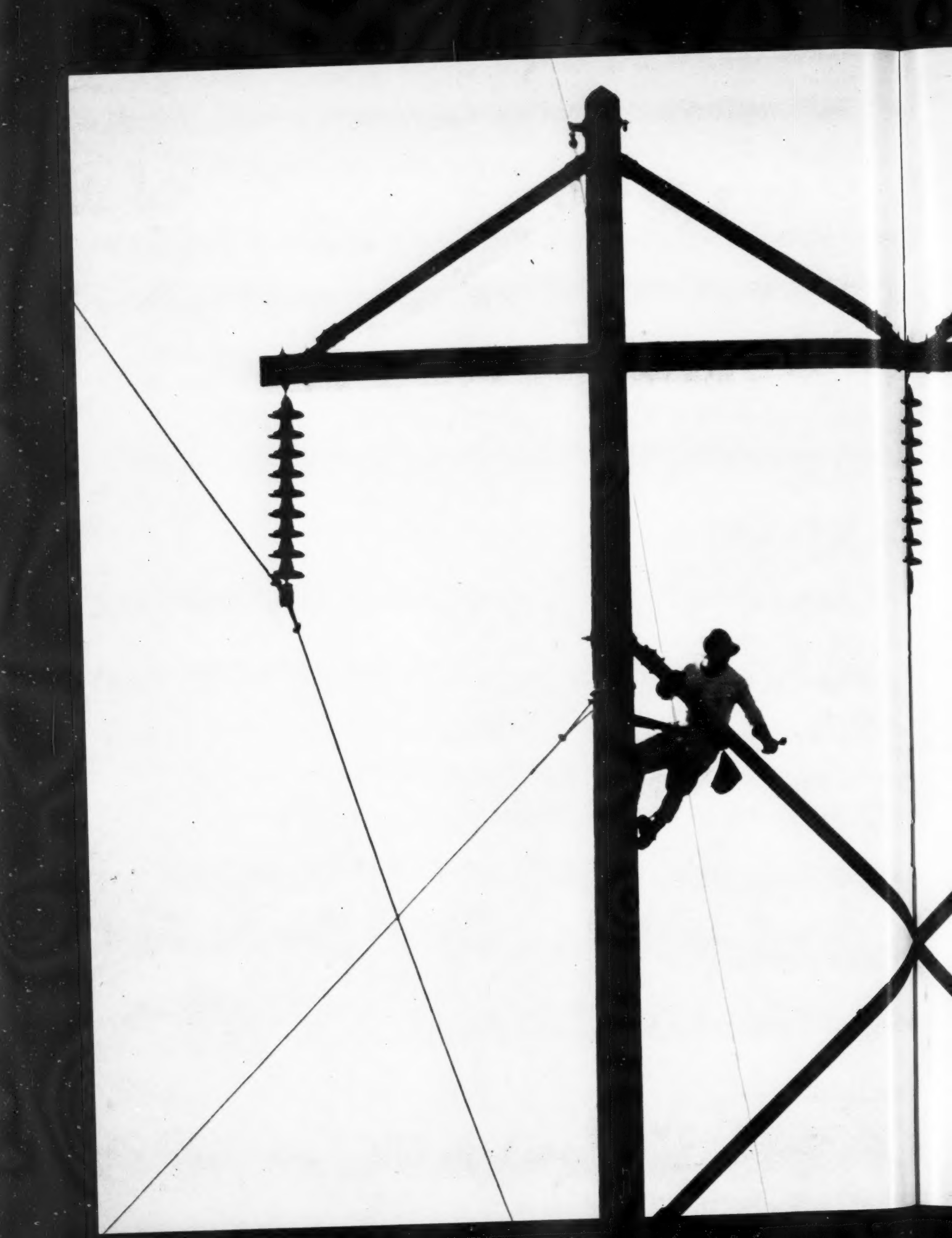
(*continued on page* 51)

PORTFOLIO NO. 25

Flip Schulke is frankly an esthetic photographer. He ingenuously admits he favors pictures that "look nice." After leaving a staff photo job at the University of Miami, Miami, Fla. he specialized in making handsome pictures for the local power company and for national magazines. Now a staffer for Black Star, he continues his industrial work to buy shoes for his four kids. On photo journalistic assignments for industry he is often confronted with actionless scenes of daily routine. He gives them a shot in the arm by concentrating on the design possibilities in the figures of people at work and the industrial scene



Schulke shot this roof-top view of an American Cyanamid fertilizer plant in Brewster, Fla., while on a Black Star assignment. Although the scene was not part of the job, he could not resist its surrealistic configuration. He made the picture with his Nikon S-2, with a 35mm Nikkor lens on Plus-X. Had it been an architectural assignment, he says he would have used a 4 x 5 view camera instead. The photograph *(right)* of technician checking temperatures during the start-up of a Florida Light and Power plant in Ft. Meyers is more typical of the use to which he puts his four trusty Nikons.



Schulke instinctively searches for any possibilities of variety in his pictures for Florida Power and Light. The acrobatics of linemen on soaring high-tension poles above the low Everglades near Ft. Lauderdale *(previous pages)* presented just such an opportunity, and Schulke brought out his 125mm Hektor to record them. The camera was a Nikon F.

This portrait of a Florida Power and Light milling machine operator is a studied attempt by Schulke to lend visual impact to a story for the firm's house organ. Schulke used a 35 with a wide-angle lens on a tripod. A light-hearted industrial requires keeping your eyes open and shooting fast, and Schulke is alert to them. A day's shooting on an assignment such as the one on which this picture was made *(right)* the start-up of a power generating plant, consists of about 150 to 200 35mm frames. Schulke expects them all to live up to his standard of quality, and a generous selection to be worthy of reader interest. He relishes exercising the printing skill he picked up as a college-student darkroom hand in Minnesota.

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ARMA SHOWS 'EM HOW WITH COLOR TRANS

There's no margin for error in assemblies of printed circuits for space age electronics. Here's how a photo unit helps improve reliability, speed production with color transparencies.—by Robert J. Eckman photographer, Arma Division, American Bosch Arma Corp.

Photography of finished, exemplary circuit board is carefully standardized from beginning to end with a standard operating procedure. Veteran photographer, Edwin Adams, sets up a shot *(left)*. Lens is 9½-in. Dagor; camera, 8 x 10 Deardorff; lights, EALs. Fred Pierce *(right)* processes 8 x 10 Ektachrome E-3.

Viewers predominate scene in assembly and inspection areas. Assemblers *(left)* and inspector *(right)* use 8 x 10 same-size color transparencies as guide in making and checking units. Requirements are exacting and the work areas are carefully controlled for cleanliness, temperature and humidity.

Printed circuit boards, used so extensively in electronics, have almost always been produced with an assist from the photographic process. At the Arma Division of American Bosch Arma Corp. in Garden City, N. Y., however, we have gone one step more than usual in applying photography to printed circuitry. Our assemblers follow color transparencies of finished circuits in producing the units, and supervisors check the completed assembly with identical transparencies.

This technique is an integral part of our system for achieving the quality standards required for the assemblies we produce. A glimpse at the end use illustrates the point. On June 11, 1960, an Atlas ICBM was fired a full 5,000 miles down the Atlantic Missile Range entirely under the control of an inertial guidance system developed and manufactured by Arma. The computer used in this system comprised printed circuit boards which were assembled and checked from color transparencies produced by the Arma Photographic Group.

Bottleneck

Before this all started, assemblies were checked against blueline prints. Many of the parts in the assemblies are color coded: diodes, condensers and transistors are banded with pigments for identification purposes. Checking involved the tedious process of reading the designation of a component from the print, translating it into the color code and then checking the assembly. J. Goodfellow, Supervisor, Printed Circuit Inspection, saw the shortcomings of the method and insisted upon a faster and more efficient means of inspection. Color photographs were suggested and the Photographic Group was called in.

When handed the problem, we based our efforts on the premise that

NSPARENCIES

any method finally employed would be repeated continually. Therefore we could afford to invest in establishing a "Printed Circuit Standard," an S.O.P. for all subsequent jobs.

Big shots

We experimented with a number of devices, processes and formats before deciding that the best medium for both assemblers and inspectors is an 8 x 10 same size transparency of a finished assembly presented on a transparency viewer.

The photographic problem was to standardize on lighting, exposure and duplication to get the best possible result with the least possible time, effort and materials.

As finally evolved, the lighting set-up is quite similar to a simple copy arrangement. The difference between photographing a circuit board and making a copy is that the board is three-dimensional. We had to light between the components. We toyed with the idea of a strong backlight on the somewhat translucent boards. This, however, would have silhouetted the leads on the back of the board, and inspection was interested in an uncomplicated view of the front of the board.

The final set-up is illustrated (*left*). The white paper reflector provides sufficient fill to soften the shadows of the components. The only things we change are the tungsten lamps, which we replace well ahead of their rated life. Thus we get a consistency which is a great help in solving our second problem: exposure.

Exposure was and is a delicate matter. A difference of a quarter stop is enough to be noticeable, and we aim for the highest quality we can get. We established a procedure for quickly compensating bellows extension. By standardizing everything we could, from the manner of reading to the placement of the reflectors we are able to hit exposure on the nose the first time.

Regardless of the number of transparencies required, be it two, three or six, we make each as an original in the camera. There are fewer headaches than if we were to duplicate transparencies, and we actually reduce the costs to Arma under other means of duplication.

We use Ektachrome E-3, Type B, film for the transparencies. We buy it by the case, and reorder when the stock is half depleted. Before the last box of a case is used, we expose a sheet of the next batch. We follow the manufacturer's recommendations for exposing and developing the new film, then carefully compare it with the results of the old.

Records help

Any alterations in speed or filtration are carefully noted for future use. In this way we are able to supply transparencies that are a close match with previous orders.

We process the Ektachrome in our year-old color darkroom. This installation includes a Calumet processing sink with temperature control and nitrogen burst agitation. Again, we had to establish standard operating procedures, and we encountered some problems. Many control strips were put through the chemicals, we stayed up nights educating ourselves in color theory, and pestered TRs with innumerable questions before we ironed out such details as nitrogen burst duration, interval and pressure, and even wash water volume.

We keep accurate charts of E-3 processing, and check our square footage total to compensate for chemical exhaustion by increasing first developer time and adding sodium hydroxide to the color developer.

We don't replenish developers (other than to maintain the volume of the first developer) but rather, we replace them at the end of their rated life or at the end of a month, whichever is sooner.

The costs of in-plant processing per transparency are quite low for us, and we have the advantages of control and quick delivery.

The finished transparencies have satisfied the Inspection Department. They have broken a bottleneck which previously backed up the whole assembly line while at times assemblies awaited inspection.

Growing utility

The success of the transparencies for inspection led to their use by the assemblers who now use the blue line prints as a reference while they use the transparencies as a master. The total effect is a considerable reduction in the time required per board in these departments. Other advantages of the system are these: 1) Less training time for new help. As J. J. Gallagher, Supervisor, Printed Circuit Assembly, puts it, "When a person has a color photograph to work from, it is easier for him to see where his efforts are headed. He knows from the start what the finished board will look like." 2) Less rejects. The color transparencies have enabled assemblers to reduce error, and thus cut down on re-work. 3) The reduction in error made possible by the transparencies has resulted in greater total reliability. Furthermore all workers have a uniform, comprehensible, and infinitely detailed guide.

The system of graphically demonstrating an assembly by means of photography is, of course, nothing new. But the benefits derived from it in this application were rather dramatic as far as we are concerned. And our experience has proved to us the value of experiment, standards and control in getting the very most out of this very important tool for visual communication.—THE END

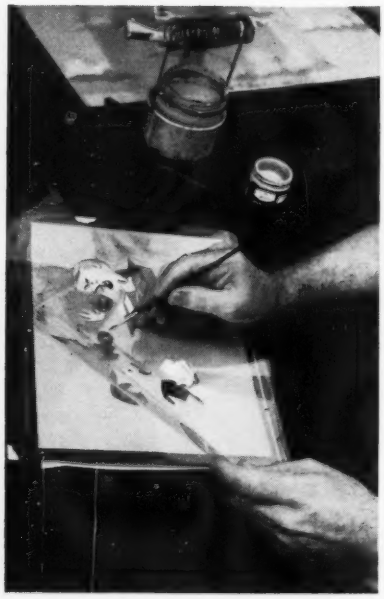
NAVY'S MOVING STILLS

Filmagraph is the Navy's term for making a motion picture of still photographs and drawings. A variation of full animation technique, the impression of movement is created by the camera, not the drawings. Combining the impact of movies with the speed of production and economy of slide films, it is used for Navy training films

Two things can move in a motion picture, the camera and the subject. In live movies, both move. In animation, the movement is achieved by a succession of drawings to show various stages in movement. Each drawing is photographed on one frame of movie film, 24 frames per second, 1440 drawings per minute of screen time. A variation of animation technique uses drawings which do not move, photographed by a camera which does.

The effect is as if a still scene were photographed with a movie camera searching to pick out aspects which the operator wants to highlight. Widely used in commercial and theatrical films, it has replaced completely the slide film or filmstrip as a major Navy training aid. At the Naval Photographic Center, Anacostia, they use the term *filmagraph* to describe their moving stills.

This technique, described here as used with drawings, is equally effective with photographs. The film on photography, *The Naked Eye*, contained very effective examples of this method applied to the work of Edward Weston and Weegee. The basic principles are the same, the only difference being in the photographic phase where the problems of contin-



Artist draws cel overlay for use with basic drawing. By using overlays, varying camera angles, one drawing may serve for three or four scenes.

Syport takes reading with incident light meter on baseboard of animation stand. Shutter speed of camera remains constant at 1/5 second.

Cameraman Carlton Syport places overlay in position over drawing on Acme animation stand. When overlay is in position, cover glass keeps it flat.

nous tone black-and-white copying are not the same as copying drawings in color.

Of all the tools available for teaching, the greatest, beyond doubt, is the motion picture. Films are unexcelled in their ability to attract attention, hold interest and convey information. This is especially true when the problem involves the instruction and indoctrination of large groups of people in a very short time, a situation which is the norm in any military training program. The huge photo installations maintained by the services give eloquent testimony to the usefulness of the motion picture in military activities.

This teaching ability is found not only in live motion pictures but the animated cartoon. In some fields, such as showing non-visible phenomena—such as a flow of electrons—it is superior to the live film. Despite its lack of realism, the animated film is extremely effective as an audio-visual technique. Its major handicap is the expense and the time involved in producing an animated film.

During the war, when time, not money, was the major cost factor, the services, including the Navy, began using filmstrips, a series of slides on a roll of 35mm film projected one frame at a time. The instructional material was supplied either by writing on the photograph itself, by an instructor or by a record which was synchronized with the filmstrip projector. These filmstrips were easy to produce, cost very little and were easy to show. However, there were drawbacks.

First, the filmstrip did not command the interest or attention that a movie did. Secondly, the problem of sound remained unsolved: human voices varied in ability and appeal while records could be damaged or played out of sync. This problem was especially acute in the fleet where the ship's movement often disrupted a slide film presentation.

Attempts were made to improve slide film methods but the essential defect—lack of audience appeal—could not be changed. This problem became acute during one presentation made by the Navy shortly after World War II. Trying to slow the headlong rush from wartime production to peacetime apathy, the Navy Department sent a Commander, armed with a filmstrip, to visit the boards of directors of defense and defense-related industries. His message was that some defense production capability should be placed on standby instead of junked. The response to his message was apathy.

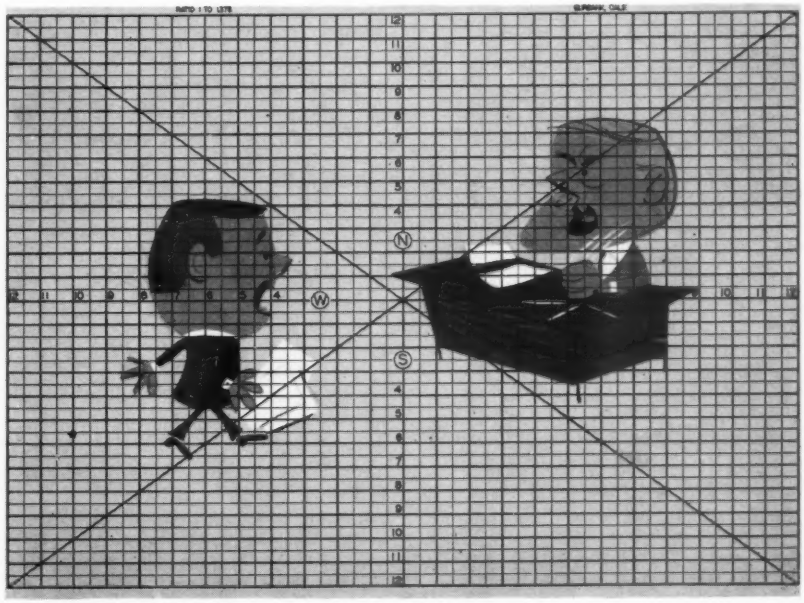
The visual impact of the strip was low and the mechanics of projection kept the message from the audience. Perhaps, the strip might be put on 16mm films. It would not be much better visually but it would make it easier on the Commander if he did not have to worry about projection. Every plant had 16mm equipment and someone to operate it.

The filmstrip and the record was, in the normal course of events Naval, sent to Transfilm in New York for transfer to 16mm sound film. During the transfer, a few animation photo techniques were included: panning, trucking-in, cutting, dissolves, etc. The result was a great improvement in the Commander's message and the first Navy filmagraph. Today, the filmagraph has replaced filmstrips completely, and full animated films to a lesser extent, as the standard Navy animated film.

Filmagraph, a term coined by the Navy, is not in itself a new technique. Another name for it is *ikonography*. It involves taking moving pictures of stills, getting the desired effects by camera movement rather

(*continued on page* 46)

For pan, drawing is moved as camera remains stationary. Camera movements, which are simulated on animation stand, create the feeling of movement.



The Acme field chart is a grid overlay measuring 9 x 12 in., the exact proportions of 35mm single frame. The grid is divided into four quadrants, North, East, South and West. It permits accurate plotting of desired camera movements since director can supply standard instructions for animation cameraman to follow.

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NAVY'S MOVING STILLS

(*continued from page 45*)

than subject (or drawing) movement. The feeling of motion is conveyed by quickly-changing camera positions and by cutting from one picture to another. An example of how strongly the impression of motion can be is the case of an officer, newly arrived on the base for a tour as a project supervisor at NPC. For about a week, the new people see various films to familiarize themselves with the techniques involved. One film was a filmagraph showing a hammer hitting a nail. Just two drawings were used: the hammer poised above the nail and then hitting the nail. By cutting from one to the other, the impression of action was created. After the screening, the officer was asked if he had seen the man who was holding the hammer. He was sure he had, but he could not swear to it. Actually, he hadn't seen the man on the screen.

The beginnings of a filmagraph are no different than the beginnings of any other Navy film, live or animated. A request for a film is submitted to the Navy Department in Washington, perhaps by the Commander of a Naval Training Station. If the request is approved, a contract is prepared. Navy films are made by outside producers as well as by the Naval Photographic Center. Who makes the film is determined by several factors. First, if the film is of a highly classified nature, such as a training film covering maintenance on a secret weapon, it will be done at NPC. All artists are cleared for "secret" material. At times, they work with a screen around their desk when handling highly classified matter. Secondly, if NPC is working at capacity and has no more facilities for another production, the contract will be let to an outside firm. A last consideration is if the film involves any special problems which might be handled by an outside firm more efficiently at less cost. An example might be a film which is to be made on location in California.

Once a film is assigned to NPC, a writer prepares a script, which, if it is to be animated, will include a storyboard. This script indicates the type and sequence of drawing involved. The script of one film includes the following art directions:

ART: Automatic production.
a. CYCLE—building blocks emerging from automatic machines.
b. TRUCK IN—to center screen on line of red blocks.

DISSOLVE

The next scene is listed as:

ART: Blocks moving across the screen.
MATCH action with movement in prior scene.

The pictures are drawings which are not animated, but which are photographed. Two scenes later, the instructions state:

ART: As is (referring to picture on storyboard).
a. PAN—east.

The actual form a film will take, whether live, fully animated, partially animated or filmagraph, is decided at a conference. If subject movement is important, filmagraph won't be used. Very often, however, it is possible to combine the two techniques where the movement is only a part of the story. Sitting in on this conference is Norman Dulin, a civilian in charge of the Art and Animation Section at NPC. It is his responsibility to provide the art and photography used for non-live Navy films.

The size of the Art and Animation section varies with demands and with the Navy's budget. The current complement includes five artists, two cameramen and three printers who make titles on cels. In addition to civilians, who are permanent, there are Navy enlisted men and officers. The Art and Animation section has provided training for many men who later became animators with various film production firms. Enlisted men are Photographer's Mates assigned to the section. Despite the value of the training received, an assignment to Art and Animation is not also an occasion for joy. Quite often, the sailor would prefer taking pictures to drawing them and it is sometimes difficult to find enlisted men who have the aptitude for this work.

Camera adjustments must be exact and in conformity with the placement listed by the director. To determine camera position, a grid square overlay measuring 9 in. by 12 in., the exact proportions of the 35mm single frame and the size of the drawing, is used. The grid is divided into four quadrants, North, South, East and West and ruled in ½-in. squares. A typical notation might direct the cameraman to shoot "four field center center." This would mean the cameraman would place his camera to cover the center four-inch area, four ½ in. squares on each side of the center cross line. If the notation read "west 2 south 2," the cameraman would photograph part of the lower left hand quadrant in-

cluded in these coordinates. The animation cameraman must have patience and be a careful, exact worker to insure correct framing and alignment.

From the artist's point of view, it is important when doing filmagraph work to avoid static pictures, to keep the screen alive. This means, too, that the writer cannot keep one picture on the screen too long. Checking one film, it was found that some change in the picture on the screen occurred on an average of every 15 words of narration. This change need not be a new drawing: a change in camera angle or an overlay is sufficient to reawake visual interest.

It is important to vary the pace of the film. If a thought expressed by the narration is complex, the picture may be kept longer than if it is simple. The subject of the narration and the drawing should agree. This is a prime responsibility of the writer of a filmagraph script, which, incidentally, is a very demanding and disciplined type of writing. In a recent film on electronic modules, the first scene showed the modules, self-contained assemblies which can be replaced as units instead of check for defective components, with the narrator saying: "The XYZ Agency after long research . . . etc." This was changed so that the picture was the same but the narration began "Modules like these were developed by the XYZ agency. . . ."

In planning the art work, the most economical way is to arrange the script so that about 30-40 drawings can provide about 150 scenes in the finished film.

Once the art work is completed, it is sent to the cameraman to be photographed. This is one continuous operation. First the sound track is recorded, then the drawings are photographed to the sound track. Using this method, no editing is necessary.

The camera technique presents no special problems. Acme animation stands are used at Navy with either 16mm or 35mm cameras. Films used include Eastman Color Negative, Plus-X, Ektachrome Commercial, Type A Kodachrome and High Contrast film. The exposures are calculated with a Sekonic Brockway incident light meter based upon a constant shutter speed of 1/5 sec. On Ektachrome Commercial, for example, based on a reading of 1M on the meter, exposure will be f/8. On Eastman Color Negative, the exposure and light reading are the same. For a reading of 94.5-ft.-candles, exposure on Plus-X is at f/4.5.

At present, there are two cameramen doing animation photography, Carlton R. Syport, Special Effects Animation Motion Picture Photographer, and Demetri Boria, Motion Picture Photographer. There are four stands so that work can be done on several films at once. Each film is shot on only one stand. Shooting time varies with the number of changes and overlays but it can average about 60 hours for a two-reel film. All 16mm and 35mm black-and-white film is processed on the base. 35mm color is sent to a commercial processor.

Because films are shot in one roll, no editing is needed but this imposes strict requirements for processing quality and physical protection of the film. Slight deviations which can be corrected for in printing are accepted but if the film is damaged or if a good release print is impossible to obtain, the picture is photographed again.

While no comparative figures are available, it is estimated that a filmagraph movie runs about 1/3 the cost of a fully-animated film of compa-

(*continued on page* 51)

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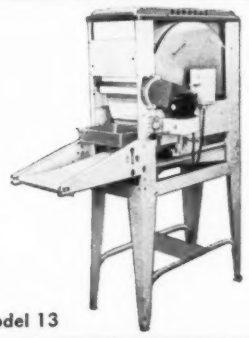
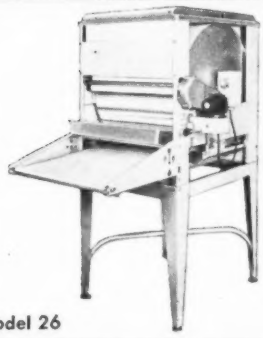


Model 13



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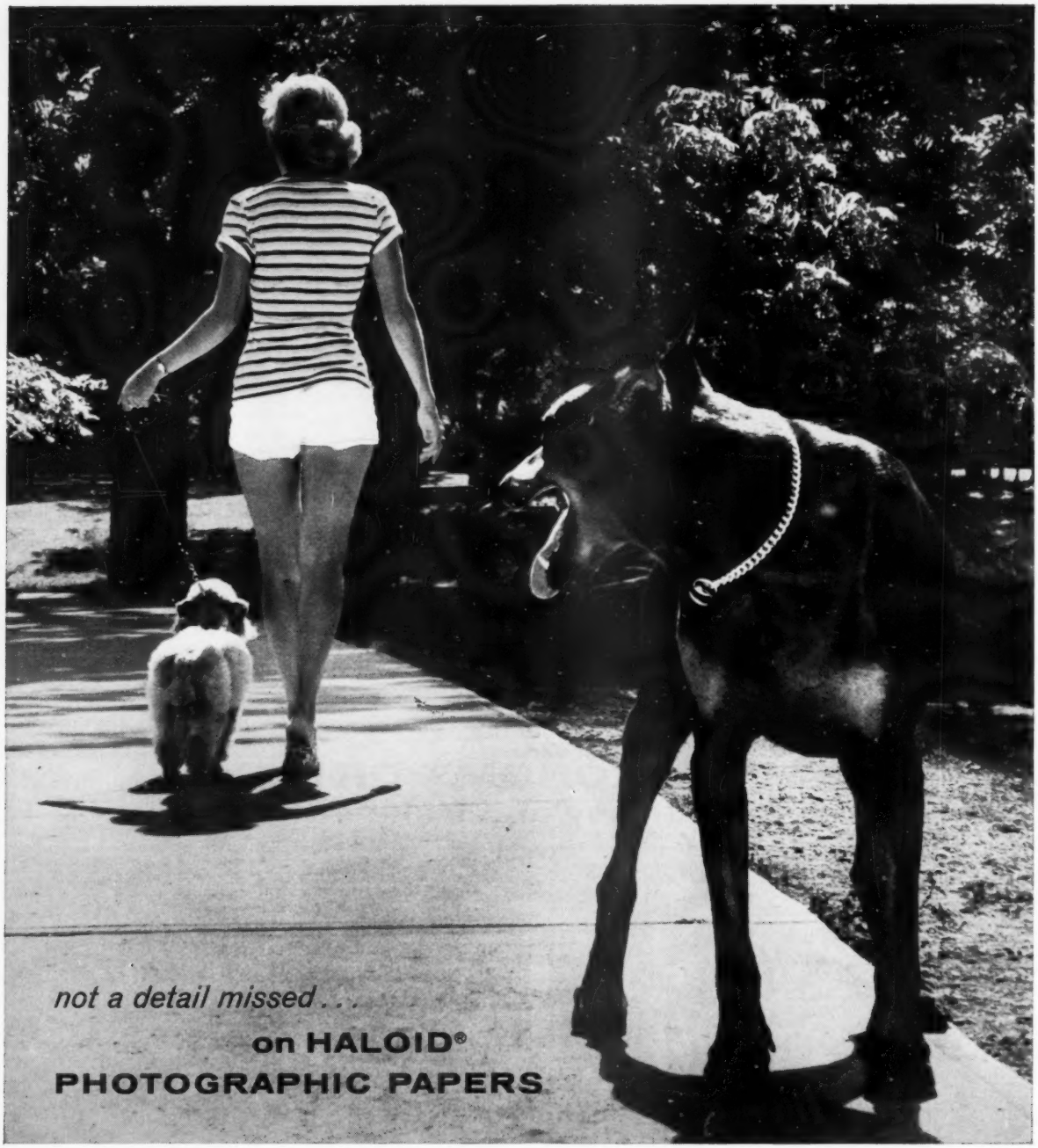

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NAVY'S MOVING STILLS

(*continued from page 47*)

rable length. In terms of art work, the time needed to turn out a filmagraph is 3½ to 4 months; comparable full animation would require eight to ten months. Actually, the cost relationship is not fixed.

Another virtue of filmagraph is its ability to create the impression of "space off-screen", a term coined by G. I. Johnson of the NPC Production Staff. He has used this in many of his films, showing only a small part of a larger action scene and letting the audience visualize the complete scene in their minds. An example he cites is a film showing a task force at sea. Actually spread out over miles of ocean, Johnson was able to get this effect by showing part of the ships entering the frame from one side. The effect created was that the rest of the task force was present but outside the screen area.

The importance of this technique is that it offers a method of economizing without losing the impact of the motion picture. A filmstrip, although cheaper, does not create the same audience response. Also, using filmagraph means that only one type of equipment is needed, instead of having both still and movie projectors. As with most things, the important cost is not how much money is spent but how wisely it is spent and what return is derived. In these terms, the Navy finds that its "moving stills" are winners.—THE END

MANAGEMENT MEMO

(*continued from page 35*)

also advises on audio-visual and related fields. In these firms, there is a photo department which is effectively, if not officially, autonomous. It provides service to anyone in the company who requests it.

Among the older industries, the photographer is still somebody with a camera to make pictures of the Annual Retirement Banquet and of the new Board Chairman. It does not make much difference where he is; his full potential is never utilized.

How many photo sections? So far, there is no answer. Indications point to one big section, however, perhaps with highly-qualified specialists permanently assigned to specific jobs. Centralized control, by a person who understands the role of photography, seems to be in the future of the many-faceted in-plant photographer.—THE END

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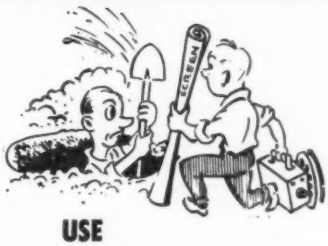

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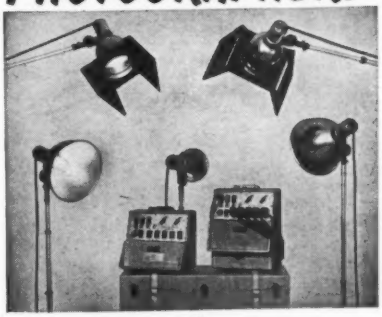

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NON-PERSPECTIV

A unique camera, developed for use by the photographic department of Procter & Gamble in making photodrawings of scale models, does the impossible: it virtually eliminates the effects of perspective. Pictures made with the unit are so orthographic that dimensions for plant construction could be read directly from the photograph itself

Already working with advanced engineering techniques through its plant model program, Procter & Gamble has now gone one step further. The company has come up with a system of non-perspective photography designed to avoid the pitfalls of conventional photodrawing, make the models even more useful.

The system is based on a non-perspective or ortho camera—brainchild of Guy Gordon of Natick, Mass., and the result of a three-way development agreement between P&G, Mr. Gordon, and Atkins & Merrill, Inc., South Sudbury, Mass. With the device, P&G is now turning out diazo photodrawings of all its modeled projects. The engineering department uses these for records, equipment layouts, and for showing information, such as pipe hangers, not included on the models.

The scale model technique does away with the need for engineering drawings in most cases, explains production engineering's Gilbert P. Hammond. But it also means there is no record and no way of reviewing and working with the design once the model is shipped. Photodrawings, says Mr. Hammond, are the logical answer.

But problems crop up with conventional photography. Perspective throws the model out of scale, makes the photodrawing difficult, if not impossible, to dimension. And conventional lighting gives confusing shadow.

The new camera, explains Richard C. Kinstler, manager of P&G's photographic department, is a single telecentric system consisting of a 22-in. parabolic mirror, a restricting aperture, a correcting lens and a film plane.

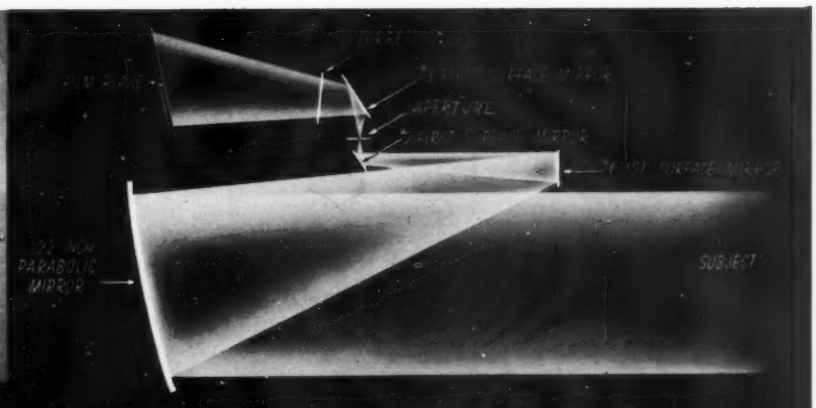
The focal length of the optical system is about 5 ft. In model photography, Mr. Kinstler explains, the camera is used to make reductions of about 50 per cent. Lens-to-subject distance is about 15 ft. First surface mirrors in the optical system neatly fold a 7½-ft. lens-to-film distance into a package of manageable size.

One take with the camera is about 6 x 6 in. on 8 x 10 film. This covers about one square foot of model. P&G photographers accomplish more extensive views by tracking either the model or the specially-designed model stand and making additional exposures. The exposures are later combined in a mosaic, which Mr. Kinstler points out is so free of foreshortening that designers can dimension the project directly from the composite photograph. Even much larger views than the one square foot coverage would be virtually free of perspective, he says, but would require a proportionately larger camera.

The restricting aperture in the system (3/32 in. diameter, equivalent to about f/500) is essential to the functioning of the camera according to Mr. Kinstler. His theory is that in conjunction with the parabolic first mirror the aperture keeps non-parallel light from the subject from reaching the film and thereby prohibits the formation of a perspective image. It also solves the depth of field problem inherent in three-dimensional models. Alignment of the camera elements is extremely important, points out Herbert A. Vonderheide, photographic methods development technician.

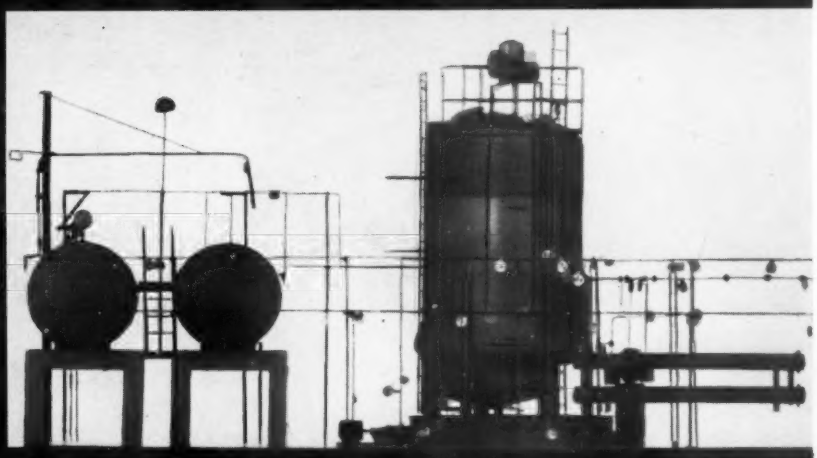
Lighting, too, plays a big part in P&G's system. Shadowless background for plan views comes from a 6 x 8-ft. illuminator base. A parabolic curved reflector, the base, distributes light evenly from two fluorescent tubes at the front. A milk-colored acrylic sheet covers the reflector. A similar

TIVE CAMERA

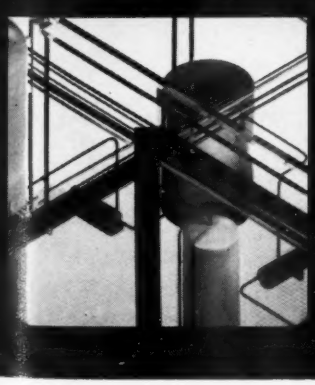


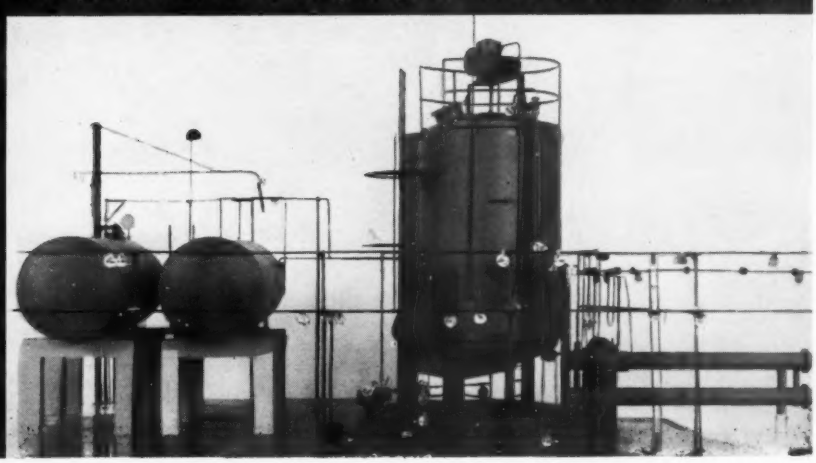
P&G Battles perspective with large mirrors and a small aperture,

The non-perspective camera is illustrated above; a P&G photographer is shown readying the unit for one of the exposures that go into a mosaic of a plant model. The optics of the lensless camera are illustrated in the diagram. Critical in the system is the aperture, which is equivalent to about f/500. The two illustrations **(right)** compare results with conventional camera-work. Note the display of the horizontal tanks and their supports. Oblique view (below) demonstrates ease with which the pictures can be dimensioned.



Non-perspective result (above) compared with conventional view (below)





4 x 6-ft. illuminator provides background for elevation views.

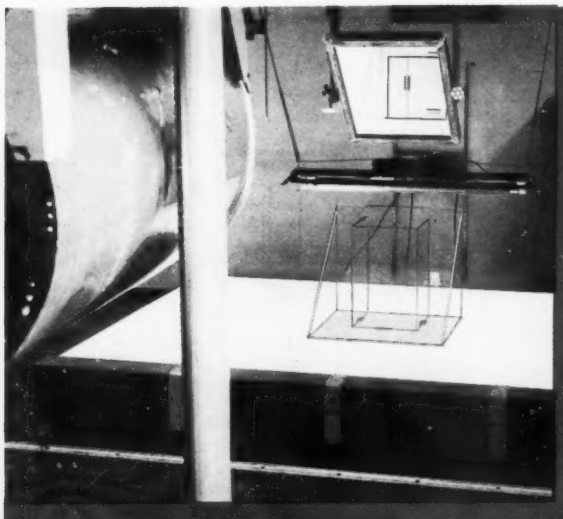
The idea for the base, says Mr. Kinstler, came from a small device made by Ideax Illuminator Co., New York City. P&G bought a design license from Ideax, scaled the design up to large size.

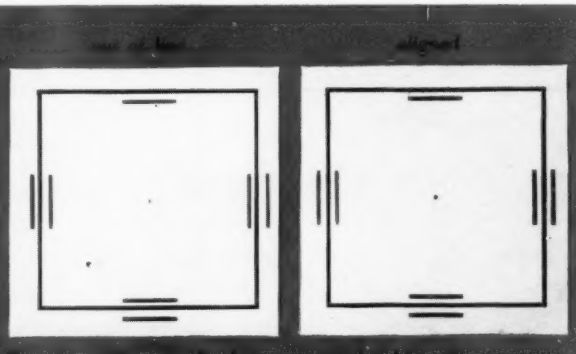
To light the model, the operator moves a lamp continuously back and forth over the model (for plan view) or in front of it (for elevations). The lamp houses two 42-in. T6 17-35-watt cool white fluorescent tubes in a reflector. The lamp is suspended from chains about 12 in. from the nearest point on the model. A reversible motor drives the chains to "paint" the model with a 2-ft. sweep of the lamp. The subsequent exposure is made with a sweep in the opposite direction. Photographers raise or lower background illumination to match frontal lighting by means of a Variac. Even with the fast film used—Kodak's Royal-X Pan—exposures run about one minute because of the small aperture. Thus, says Mr. Kinstler, the moving lamp between the model and camera doesn't show up in the final photograph. The back of the reflector is painted matte black.

Photographing the model is just the first step in the process because the model is photographed in sections. Plan view and elevations for a typical 6-ft. by 12-ft. by 4-ft. high model, require more than 400 8-in. by 10-in. photographs, according to Mr. Kinstler.

A plastic fixture aligns the model properly with the camera. For vertical positioning, the camera rides up and down on supports. A mirror suspended above the model at 45° provides the image for plan views.

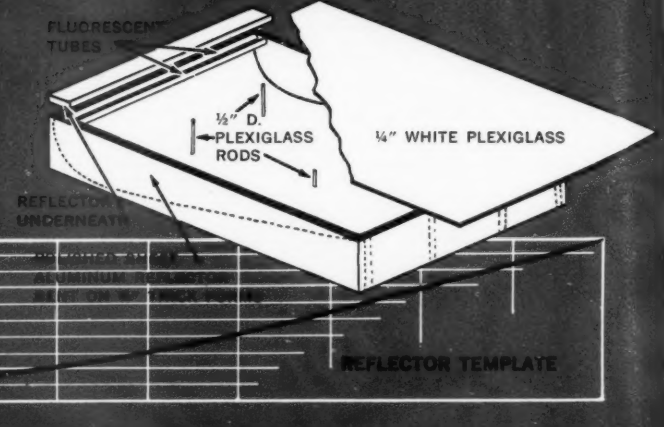
The exposed Royal-X Pan film is developed for 7 min. in DK-50 at 68F with nitrogen burst agitation. Aim point is a 1.5 background density





Precise alignment of camera and subject is necessary for the accuracy P&G gets in its finished photographs of plant models. The plastic stand which holds the model *(left)* also serves as a target for alignment (see ground glass views above, photographed with 45° mirror).

White backgrounds are made easier with illuminated table shown in photograph *(above)* and diagrammed *(below)*. The curved surface of the reflector spreads the illumination of the fluorescent tubes evenly to translucent top. P&G enlarged the scheme from a commercial transparency illuminator after obtaining the right to use design patent.



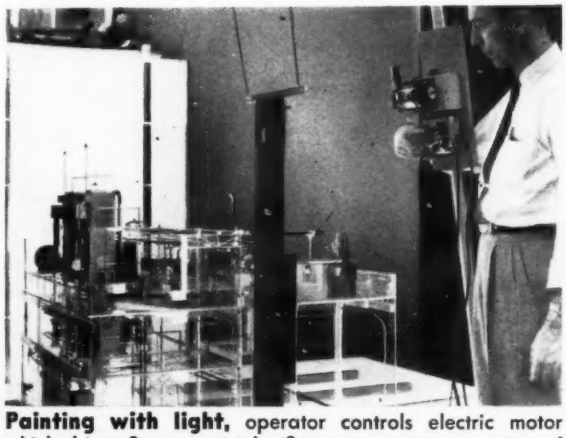
NON-PERSPECTIVE
(continued)

as read on an Eastman 1A Densitometer. This density level results in a clean separation of model from background. Negatives as well as prints of each model are developed as a group for the sake of uniformity.

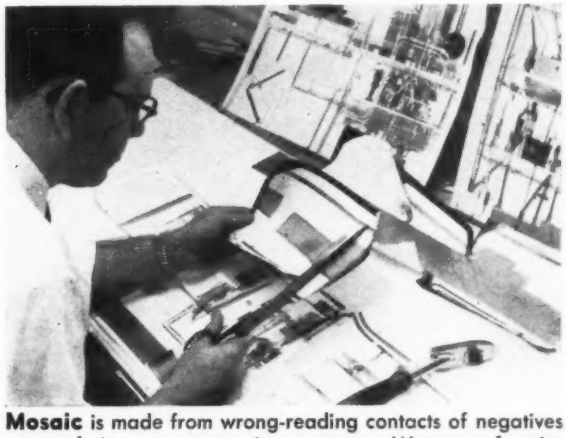
Reverse contact prints are made of the negatives (except for plan views, which are already reversed by the mirror) and then assembled into a mosaic to make up an entire view. A vacuum frame and point source illumination insures sharp images of the flopped negatives. Kodak Resisto Rapid No. 2 paper is used; processing time is kept to a minimum and prints are air dried to minimize dimensional change. Dry mounting is used for the mosaic, but press temperature is moderated to avoid shrinking the prints.

The mosaic is photographed with a process camera using a 120-line magenta screen. A detail exposure based on shadow density is used with a "bump" or non-screen exposure to increase the contrast of the halftone negative. Percentage range of the halftone dot is about 5 to 95 per cent. It usually takes two sections to make up the screen negative, explains Mr. Kinstler, since the process camera isn't large enough to record the entire view.

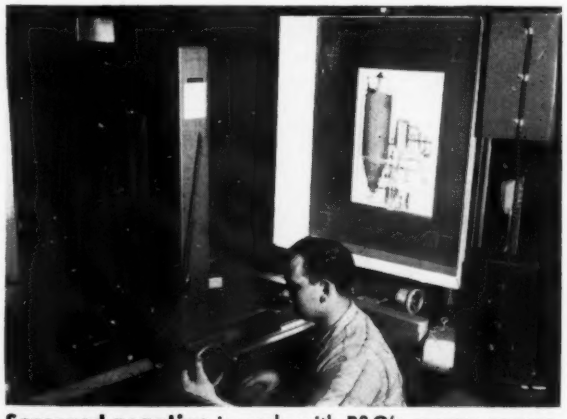
The photographer assembles the screen negatives on an opaque layout sheet, which is cut away behind the negatives. The layout can include either a single view or both plan and elevation. Next step: Make a screen positive on a polyester sheet film (Cronaflex PFM4) which then becomes the repro- (*continued on page* 83)



Painting with light, operator controls electric motor which drives fluorescent tube fixture across camera view of subject. Exposure runs about 1 min. Pictures are shadowless.



Mosaic is made from wrong-reading contacts of negatives exposed in non-perspective camera. Waterproof print paper, quick processing, air drying help keep size.



Screened negative is made with P&G's process camera. Aim is a high-contrast (dot percentage ranges from about 5 to 95 per cent) 120 line, same-size negative of mosaic.

Piecing screened negative together (camera is not large enough for all drawing sizes), P&G man makes a butt splice, prepares mask for wrong-reading Cronar positive.

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Herbert P. Paschel

GRAPHIC ARTS

Swiss expert cites advantages of electronic flash in reproduction

As a sequel to a recent column on photographic light sources, the results of a comparison test between arc light and electronic flash are particularly revealing. The following data are condensed from the full report by R. von Wartburg, (*Photographisches Institut der Eidgenössischen Technischen Hochschule* in Zurich) which appeared in *Der Polygraph,* issues Nos. 13 and 20, 1959.

In order to rule out the influence of the peculariarities, or differences, of sensitive materials, the tests were conducted using five different, but related, emulsions from three manufacturers.

The tests revealed that a single flash exposure consistently produced better tone separation by virtue of an extension of the straight line portion of the characteristic curve. As shown in Figures 1 and 2, a better distinction in the shadow tones and less flattening out in the highlights seems to be a typical improvement in negative quality induced by electronic flash.

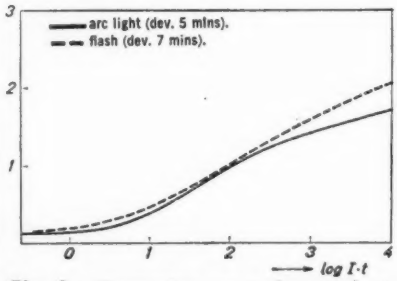

Fig. 1 Comparing arc and equivalent electronic flash exposure with Kodak Tri-X, Type B, Plates.

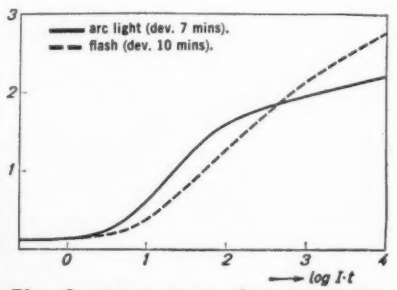

Fig. 2 Same tests, this time using Kodak Panchromatic Plates.

On the other hand, the inherent advantages of a single flash exposure are lost with multiple flashes. As can be seen from Figure 3, the difference between a single flash exposure and a 20-sec. arc light exposure is significant. But when the total equivalent exposure with flash is divided among an increasing number of repetitive flashes the characteristic curve soon approaches that of the arclight exposure.

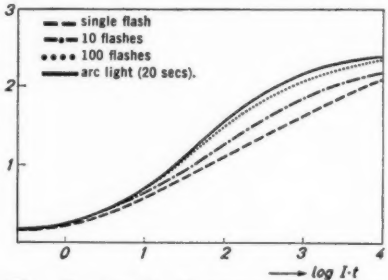

Fig. 3 Family of curves shows how result varies with number of flashes.

The study also confirmed the well known fact that, with normal development, negatives exposed with electronic flash have lower inherent gamma values. A comparison of filtered exposures, Figures 4A and 4B, indicates that the gamma values of a color separation set exposed by flash are reasonably equal throughout the full range of development times. The set exposed by arclight, on the other hand, shows different gamma values for the four negatives at any time-gamma value, with the difference increasing with higher gamma.

In the opinion of the author, the extended straightline portion may minimize, or completely eliminate the need for highlight masks. He also cautions that exposure and development experience gained with

(*continued on page* 58)

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arc and other illuminants cannot be applied to the flash technique. The successful application of electronic flash in graphic arts photography requires carefully controlled tests to establish the proper relationship of exposure and development for a particular condition and sensitive material.

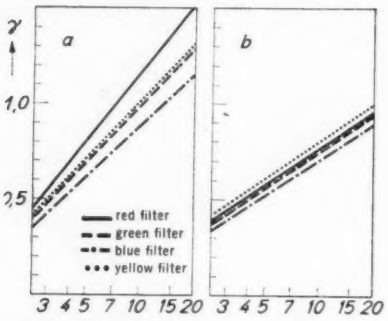

Fig. 4 Developing time in minutes vs. gamma for separations with arc light (a) and electronic flash (b).

E pluribus unum

According to Harry L. Parker, President, American Speedlight Corporation, xenon lamps are proving themselves to be a superior light source for many graphic arts applications.

Of the many types now available, the single flash xenon tube seems to produce the highest overall quality for continuous tone separation work from color transparencies.

On the other hand, the pulsed xenon arc (PXA) has an extremely high efficiency factor for converting electrical energy into light energy. In addition, since the PXA lamps are available in a variety of sizes, the maximum intensity required for any application can be readily obtained by means of lamp size or multiple units.

In the case of the flashtube, exposure variations are obtained by varying the discharge voltage or, in the case of fixed capacity, by multiple flashing. Both of these exposure controls introduce certain problems since the photographic response, i.e., the characteristic curve, may vary.

A number of continuous burning xenon arcs are reported to be in the process of development. One, a high pressure type was exhibited at the recent graphic arts exposition in Paris. Heat dissipation by means of circulating water is necessary. Personally, this writer does not view watercooling with enthusiasm having had quite unsatisfactory experience with similar light forms. Many years ago a high pressure mercury-vapor tube with water cooling was offered to the graphic arts as a replacement for carbon arcs. Impurities in the water gradually accumulated on the outer wall of the discharge tube and the inner wall of the water jacket. In time the accumulation achieved sufficient density to cut down the light intensity by 50% or more. Another hazard is any interruption in the flow of the coolant. With complete stoppage, or considerable slowing down, the temperature of the tube would increase until the quartz glass would soften, deform and rupture. These problems may, or may not be inherent in water cooled lamps of current design.

The evidence that is piling up through practical experience indicates that many of the newer light forms do have advantages over the traditional light sources. But it is also obvious that the modern light sources have a much higher initial cost than the old. Despite better performance, the cost factor alone will make the transition a long and gradual one.—THE END

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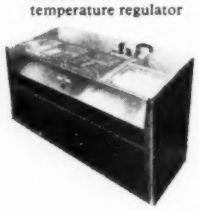

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MONDAY, OCTOBER 10th

2:00 P.M.—Presentation of Life Magazine's filmstrip "THE MARKET OF THE SIXTIES".

3:00 P.M.—Symposium: "THE PHOTOGRAPHER IN OUTER SPACE".

3:00 P.M.—"THE PHOTOGRAPHER IN SPACE"—A presentation of the relationship and importance of the photographer and photography to our missile and space exploration programs, presented by a Space Team of Experts.

5:00 P.M.—Lecture-Demonstration by Lloyd Matter and Robert Heydenburg: "INDUSTRIAL USE OF CLOSED CIRCUIT TELEVISION".

TUESDAY, OCTOBER 11th

2:00 P.M.—Lecture by Robert L. Lawrence, New York City: "WHAT MAKES A SELLING COMMERCIAL?".

3:00 P.M.—Presentation of the prize-winning publicity films and television commercials from the 7th INTERNATIONAL ADVERTISING FILM FESTIVAL in Venice.—June 1960, and lecture by Hudson Faussett, judge at the Venice Festival: "COMMERCIAL FILM TECHNIQUES—HERE & ABROAD".

5:00 P.M.—Lecture by Josef Bohmer, IBM Product Development Laboratory: "SINGLE-SYSTEM FILM PRODUCTION".

WEDNESDAY, OCTOBER 12th

10:00 A.M.—(all day)—A CONSULTATION CLINIC Presented by the Metropolitan-New York Audio-Visual Association.

11:00 A.M.—Presentation by the National Educational Television and Radio Center, with a showing of their color promotional film "KNOWLEDGE AND IDEAS".

12:00 noon—Production Workshop and Luncheon-Meeting by the Radio & Television Executives Society on "FOR PROPHETS AND PROFITS—EDUCATIONAL TELEVISION".

2:00 P.M.—Lecture presented by Frank Carioti: "DESIGN FOR LEARNING".

3:00 P.M.—Symposium on MODERN LANGUAGE LABORATORIES.

3:00 P.M.—Workshop Session: "VISUAL COMMUNICATIONS IN BUSINESS & INDUSTRY".

THURSDAY, OCTOBER 13th

2:00 P.M.—A first hand visual report by Adolph Wertheimer: "WHAT WAS NEW AT THE PHOTOKINA".

3:00 P.M.—Symposium: "WHAT 8MM CAN DO FOR BUSINESS & INDUSTRY", moderated by John Flory, Eastman Kodak Company.

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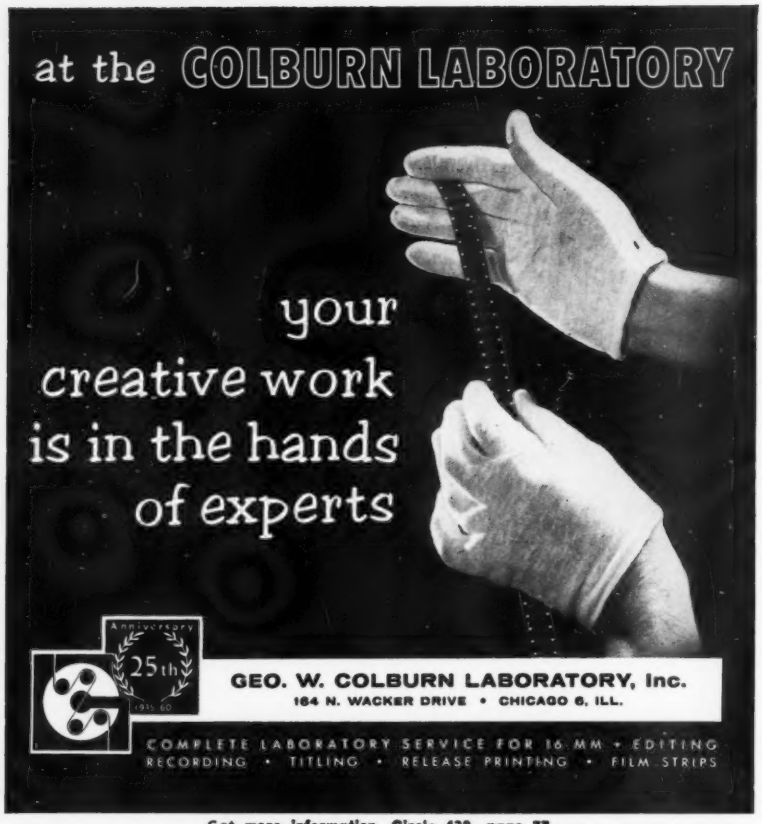
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IND. MOTION PICTURES

(*continued from page 27*)

One way of plotting and checking movement in three-dimensional animation shooting is to set up an 8 x 10 still camera beside the animation camera. Then, with a grease pencil, plot the course and final position of the subject on the 8 x 10 ground glass. Another method is to use a light stand with an arm clamped to it. This may be utilized as a surface gauge. Before each exposure move the stand so that the arm touches the subject. Then turn or move the subject ¼ in. or 1/16 in. or whatever your timing calls for. Remove your gauge before each exposure.

New techniques are constantly being developed. There is the rear projection aerial image, developed by John Oxberry for the Oxberry animation stand. Its principle is the projection of live action by a film projector from the bottom of the table to a large set of optical condensers 18 in. in diameter. This forms a clear, sharp, grainless image which is picked up by the animation camera. The camera lens must be the same distance from the condensers as the projector and have the same focal length lens. To facilitate the use of the underneath projector a surface coated mirror, tilted at 45° is employed. On top of the condenser with the projected image —which becomes the copy table—one can lay cels with animation and actually use the projected live action as a moving background. Or one may use cels with titles, thus eliminating the costly matte process which is usually done in an optical printer for titles with moving background. The greatest advantage of the aerial image is that unlike background rear projection to a screen, the aerial image is not affected by top lighting. Thus the cels, or even three-dimensional objects, may be lit without affecting or degenerating the projected image.

I have barely scratched the surface of this vast subject. Unfortunately, there are very few books that deal adequately with the technique of animation. Hastings House published a book from England last year dealing with this subject. It is *The Technique of Film Animation* by John Halas and Roger Manvell, which, while interesting, is not a text book. Ernest Pittaro who published the *TV and Film Production Data Book* last year, has had a great deal of experience in animation technique in this country. He is completing a book on animation which should be out shortly.—THE END

PMI IN-PLANT REPRODUCTION

Vernon Tate

MICROREPRODUCTION

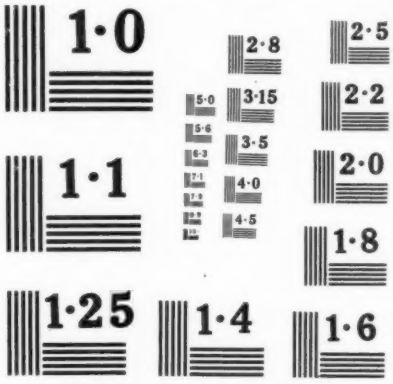
Microcopy resolution test chart: Where to get it, how to use it

The entire concept of microphotographic reproduction rests on the ability of photographic processes to reproduce originals at considerable degrees of reduction *and* subsequently to recreate the original in facsimile for viewing or reading, as in a reading machine, or by making acceptable paper prints. In the early days a well accepted rule-of-thumb definition of a good microcopy was one "which could be enlarged back to original size without noticeable loss of definition."

Inevitably the need arose for more effective systems of measurement which could be used to evaluate completed microfilms or the principal components in quantitative terms which in turn could be used to predict future probabilities. Existing systems for measuring "resolving power" in use for testing lenses and photographic emulsions were explored and adapted to meet these requirements. Without for the moment entering into the history or the course of these investigations, a field which is not without differences of opinion, it is enough to record the fact that a test pattern emerged that could be photographed by the microfilm camera, and which, when properly evaluated or interpreted, would yield values expressed in lines per millimeter (lines/mm). These values came to be termed "resolution."

The standard test pattern was prepared by the Photographic Technology section of the National Bureau of Standards. It is generally available; orders should be addressed to the Standard Sample Storeroom, National Bureau of Standards, Washington 25, D.C. and should specify Standard Sample 1010. The price is 20¢ per chart, minimum order five, remittance must accompany the order; stamps are not accepted.

The Microcopy Resolution Test Chart (NBS) reproduced herewith consists of 21 patterns each of ten lines and ten spaces. Lines and spaces are of equal width and each pattern has two sets of fine lines and spaces arranged at right angles to each other. The patterns are numbered as follows: 1.0, 1.1, 1.25, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.15, 3.5, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 7.9, 8.9 and 10. which indicate a range of from 1 to 10 lines/mm with some intermediate steps which have been found useful.



NBS Resolution Test Chart

In use the Bureau recommends that not less than three charts be placed in the field on the copyboard of the camera. One is positioned in the center, the second in the center of the long side and the third at the corner. The last two charts are placed so that one is radial and the other is tangential with respect to the center of the field. As a practical matter, since the charts are prepared on glossy single weight photographic paper it is well to mount them on cardboard or metal, making due allowance in focusing for the thickness of the mount, in order to insure a flat surface. Military Specification MIL-M-9868, incidentally, requires the use of five targets. One is placed in the center of the field and one in each corner.

The test chart is then photographed in the usual manner, the film is processed and the resulting

(*continued on page* 63)

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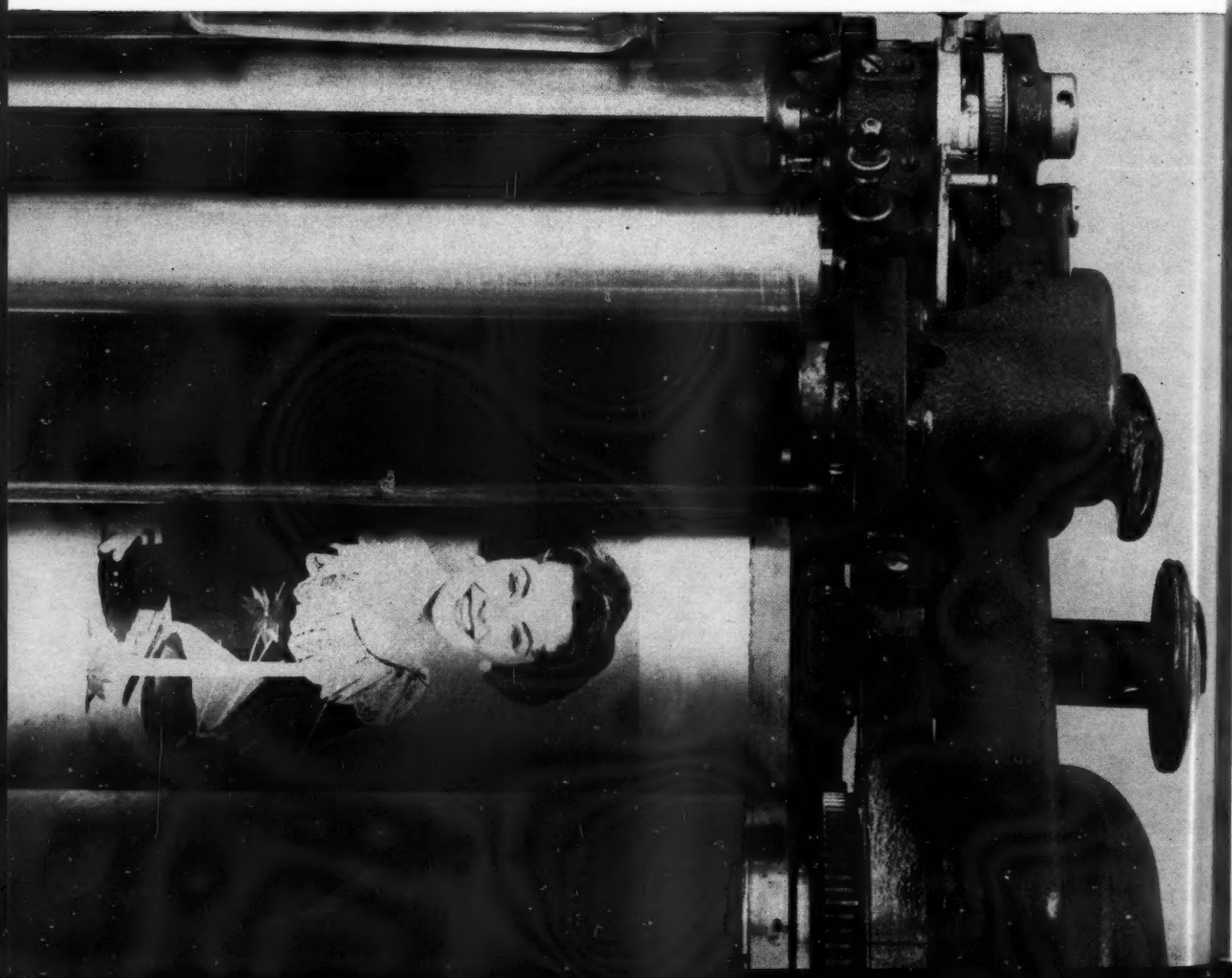

(*continued from page 61*)

negative is ready to be examined. For this purpose a microscope with a magnification of 40-50X is required. The degree of magnification often depends on the preference of the individual or the limitations of the instrument that happens to be available. The figure for the number of lines in the smallest pattern that can be *counted with certainty* multiplied by the linear ratio of reduction employed determines the resolution. If, for example, a reduction of 10 is used and the smallest pattern is 8.9, then the resolution is 89 lines/mm. Each target on the film should be read. The optimum result of an identical reading for each target is rarely achieved, therefore the poorest target resolved becomes the measure of resolution of the frame. The center target may read in excess of 100 lines/mm while the corner target reading may fall to 89 lines/mm. The latter becomes the solution value for the frame.

In the valuable though brief instruction sheet which accompanies the NBS test chart it is pointed out that reduction in microcopying is limited by the resolution of the lens and the film emulsion, and that the resolving power of the best short focal length lenses *in the center of the field* is higher than the resolving power of the best film. At 20 or 30 degrees off the axis of the lens, the resolution falls off sometimes as much as 50 per cent. Values of 60-70 lines/mm for ordinary motion picture positive film and 130-150 lines/mm for the best microfilm are given. In the opinion of the writer, the values for the best microfilm are unduly conservative.

It has also been the experience of the Bureau that the positioning of the lens in the focusing mount in the camera is often in error causing loss in resolution. The test chart can be used to test for focus by making a series of exposures, moving and recording each change on the focusing scale, processing and reading the film in the usual manner.

Vibration caused either by faulty camera design or a location in a building which transmits vibration to the camera can also be tested. A series of exposures with the chart in the center of the field, followed by another set of exposures with the chart rotated through 45 degrees is the proper method. If the lines in both directions at both placements of the chart are equally resolved, the camera is free of vibration. Somewhat similar means can be used to test flow cameras for lack of synchronization between movement of original and film.

Recommended practice calls for several photographs of resolution charts to be made at the beginning and end of each roll of microfilm in order to provide means to check the film, camera and processing. The instruction sheet also contains general standards of quality and a correlation intended as a guide for microreproduction quality.

There is no doubt that the resolution chart properly used is a most useful tool in the production and use of microcopies. For many purposes it is completely adequate; for others it is something less than ideal. The greater the required degree of precision, the greater the difficulties will be in reaching and maintaining an optimum level of achievement.

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(*continued on page 72*)

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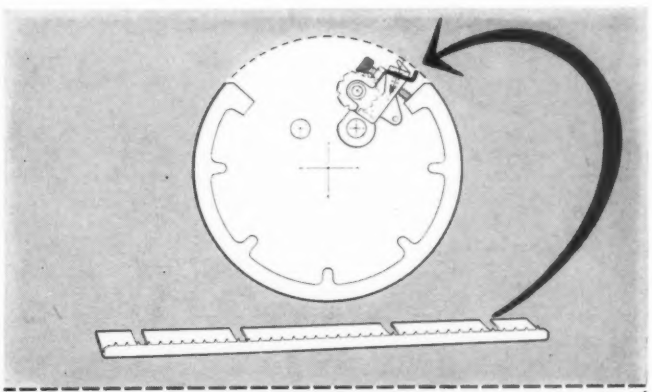

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HYZER ON HIGH SPEED

Theory on what makes a high-speed movie move; the determination of picture frequency in terms of time-magnification for the event—Wm. G. Hyzer

In past articles of this series we have discussed various criteria that should be considered in order to optimumize the quality of data derived by high-speed photographic techniques. The effects of depth of field and image blur have already been considered in some detail. This month, two additional factors will be described—both unrelated to image structure and blur.

Actions destined for analysis by projection (and not by frame by frame data reduction procedures) require special consideration to assure that image movement between frames does not exceed the critical dimensions of the image in direction of motion; otherwise the illusion of continuous movement of the subject would be destroyed. This condition is satisfied by using a picture frequency (in frames per second) greater than the ratio of subject velocity (in feet per second) to the critical subject dimension (in feet); or F is greater than S/P. This inequality arises from the fact that a satisfactory facsimile of the original motion is obtained on the screen if the subject does not move further than its own length during the time interval between successive frames.

Another limiting factor in the estimation of picture frequency is the required time magnification of the event, a condition unrelated to both subject velocity and image structure. For example, in photographing a rapid chemical reaction, the actual velocity of motion in the reactor may be relatively slow, however the spontaneous decomposition of material may occur very rapidly throughout the entire volume of the reactor and require a high frame rate to magnify successive stages in the reaction. The picture frequency required to analyze a given action on the screen is determined to a large extent by the complexity of the particular action undergoing study. For example, a projectile breaking through a sheet of paper is a relatively simple action having a duration determined by the time it takes for the projectile to penetrate the sheet. The minimum number of frames required to analyze the action in this case is on the order of 6 or 8. The same projectile shattering against a steel plate represents a more complex action that may require as many as 20 to 30 frames to entirely interpret the phenomenon throughout the same time interval. Referring to the chart, duration of action in seconds appears as abscissa; the ordinate is picture frequency in frames per second. The family of diagonal lines running across the chart represents the number of frames required to record an event at a given duration and picture frequency. Cross-hatched areas on the chart show the recommended range of operating conditions for both simple and complex actions. A simple action projected on a screen may be analyzed with as few as 6 to 8 frames, as already stated, however, 20 to 30 frames may be required for actions of greater complexity. For purposes of qualitative interpretation of the projected image, there is an upper limit for the time the total action should appear on the screen. As a general rule, a very simple action should be limited to only a few seconds projection time, corresponding to about 60 frames; while even the most complex event does not ordinarily require more than 10 seconds projection time (or 240 frames). The same general rules apply to films that are to be quantitatively analyzed. Simple actions may be plotted by a relatively smooth curve and require a minimum of data points. The more complex the motion becomes, the more data points are required to chart its course within the required limits of accuracy. Operating ranges for both simple and complex actions are shown on the chart in color. For an event of given duration a picture frequency should be chosen so that the number of frames required to record the event fall within the limits indicated on the chart. The duration of an event may be interpreted in numerous ways. For example, in photographing a projectile passing in front of the camera, the duration of the action is simply the time the projectile is visible within the field of view. In the case of a rotating gear, the duration corresponds to one com-

plete rotation of the part. A vibrating spring has a duration corresponding to the period of one vibration. A scale across the top of the chart is calibrated in terms of cycles per second or revolutions per second to facilitate this type of analysis. For an object moving directly toward the camera, the duration may be interpreted in terms of the time the object remains within the depth of field of the camera lens. These are but a few of the many interpretations possible in the use of this chart. It should ordinarily be used in conjunction with the methods previously described to yield a compromise or "best estimate" of camera speed.

Example: We wish to photograph the ejection of a dummy from a supersonic sled as it moves through the camera's field at Mach 1.5. What picture frequency (F) and shutter constant (ρ) are required for the analysis of this action by projection under the following list of conditions?

1) sled velocity (S) = 1630 ft. per sec. 2) field width (W) = 40 ft. 3) duration of ejection (T) = 0.02 sec. 4) tolerable image blur = ½ per cent of frame width 5) width of the subject in the direction of motion (P) = 1.2 ft. 6) picture frequency (F) = ? 7) camera shutter constant (ρ) = ?

Based on this month's chart a complex action of 0.02 sec. duration may be photographed at a picture frequency ranging anywhere from 1200 to 12,000 frames per second. A further refinement in the picture frequency estimate is based on the inequality F is greater than S/P,

which sets a lower limit of $\frac{1630}{1.2}$

= 1360 frames per second. Therefore, a picture frequency ranging between the limits of 1360 and 12,000 frames per second appears satisfactory. For optimum results the geometric mean of the above two values probably represents the best compromise:

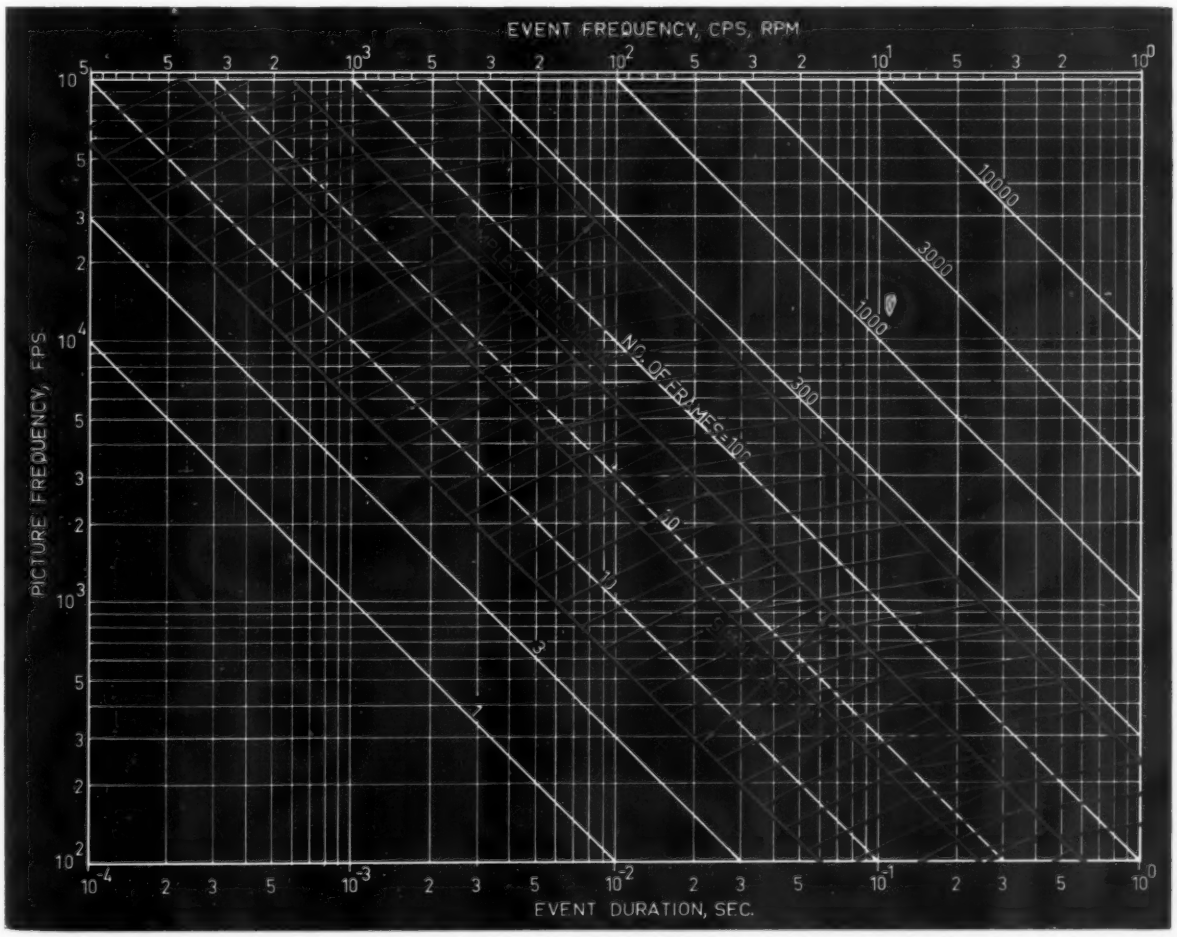
F optimum = $\sqrt{1360 \times 12{,}000}$ = 4000 (approx.) fps

Next, what limiting value of the shutter constant (ρ) is required to maintain image blur within acceptable limits? This value is derived from the author's chart that originally appeared in the July 1960 issue of PMI, using the figures S = 1630, W = 40 and F = 4000. From the chart we find that the shutter constant (ρ) should not exceed 0.5 if image blur is to be restricted to less than ½ per cent of the frame width. Therefore, recommended values of picture frequency and shutter constant become:

F = 4000 frames per sec.

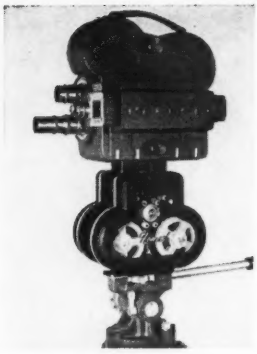
ρ is less than 0.5

If a lower picture frequency should be chosen, ρ would have to be decreased accordingly.—THE END

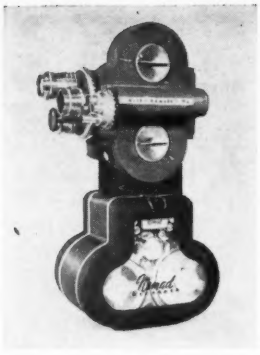


Ed. note: The material presented is representative of that in Mr. Hyzer's book, **Photographic Techniques of Motion Analysis**, the Macmillan Co.

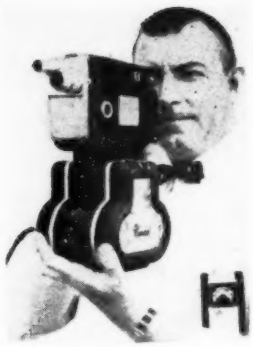
Nomad/Arriflex



Nomad/Auricon



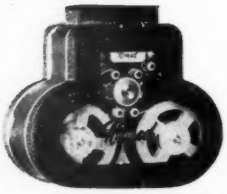
Nomad/Bell and Howell-70

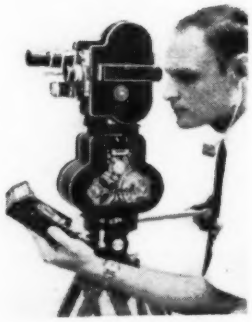


Nomad/K-100

MAGNASYNC

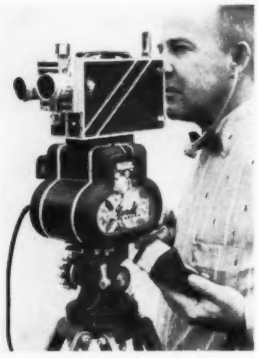
The *Nomad* 7 lb. recorder-reproducer for 16mm movie cameras





Nomad/Bolex

Nomad/Bell and Howell-240



Nomad/Cine-Special

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PICTURES HELP CALIBRATE METERS

Bicycle pump, air hose and Polaroid cameras make photos to correlate instrument readings, check out the accuracy of high volume turbo meter for the benefit of manufacturer and customer—H. E. Rittenhouse, Chief Engineer, Petroleum & Industrial Division, Rockwell Manufacturing Company

When engineers at our Meter and Valve Division began conducting calibration and repeatability tests on a new turbine-type meter in June, 1957, they faced a really tough problem on data recording.

The new meter, known as the Turbo-Meter, was of radically new design and had a capacity of 15,000 barrels per hour with liquids up to 500 SSU viscosity. The prototype unit had been installed in a standard 16-in. piping system, and a liquid was pumped through it from a storage tank into a receiving tank mounted on an accurate scale.

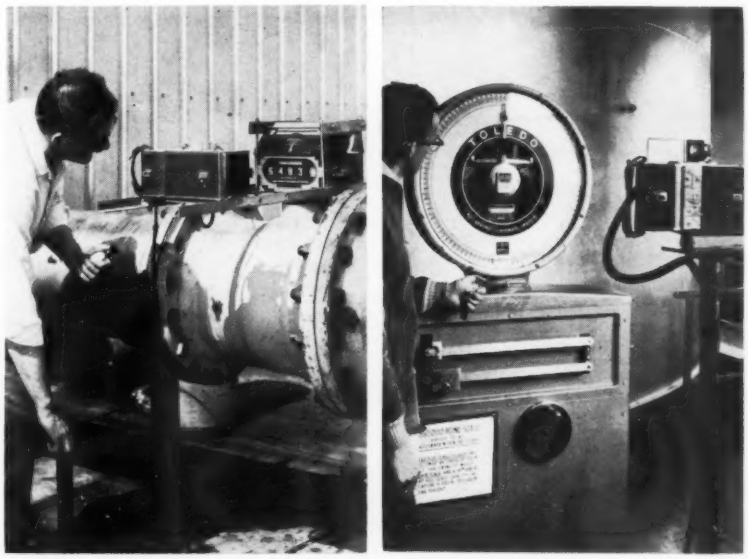
A register head attached to the Turbo-Meter recorded the number of barrels of liquid that passed through it, and the scale recorded the weight of liquid collected in the receiving tank, called a weigh tank. At regular intervals during a test, two engineers—one at the Turbo-Meter and the other at the scale—were supposed to make simultaneous readings. The information would be computed and analyzed to determine the meter's accuracy.

Although this method had proved successful for testing smaller capacity meters, the drums on the register head turned so fast it was impossible for an engineer to "stop" a reading simultaneous with a man at the scale.

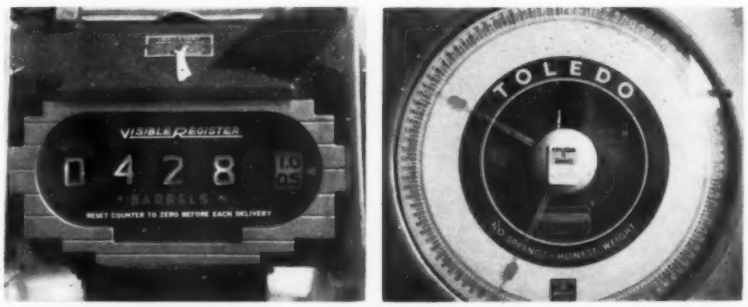
And because the Turbo-Meter was—and is—an innovation in the area of positive displacement or high-capacity flow meters, the engineers had to obtain readings that met extremely close tolerances in order to plot a performance curve for the instrument. Inaccurate readings would be meaningless.

An idea of the speed at which the register drums turned may be

(*continued on page* 84)



Camera set-ups enable engineers to make test photos with a minimum of assembly time and adjustments. A jig positions camera for recording dials of Turbo-Meter under test *(left)*. A permanent camera stand *(right)* holds camera for weigh scale record. Pneumatic shutter tripping devices on cameras are both connected to a bicycle pump *(left)* so engineer can trip them simultaneously. Weigh scale is standard of accuracy for meter reading.



Typical results of Rockwell's Turbo-Meter calibration photography are shown above. Meters move too fast for test engineers to read them with the precision required, but the photographs freeze the results for later plotting.

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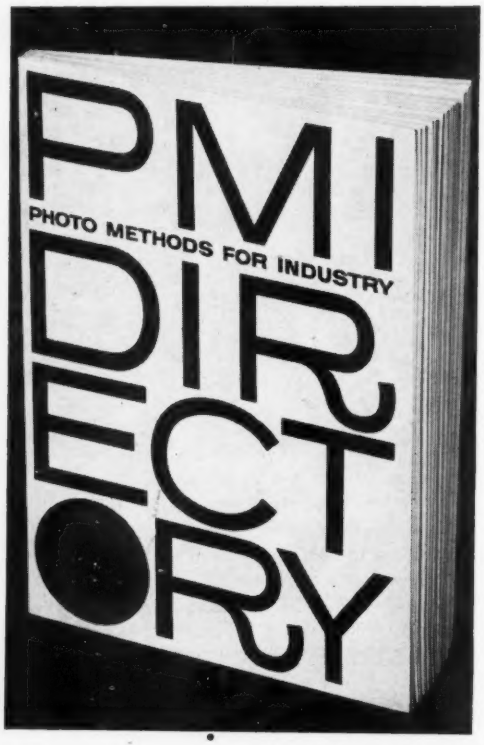

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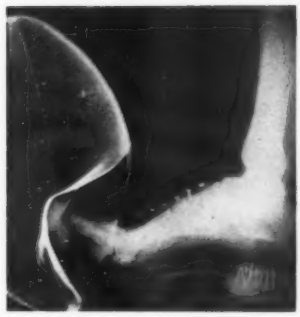


Society of Photographic Scientists and Engineers (SPSE), Society of Motion Picture and Television Engineers (SMPTE) will sponsor October meetings on High-Speed

As far as is known there is no way of measuring it, but it might be interesting to speculate on the amount of photographic brainpower gathered in Washington next month for the High-Speed Photography Congress and the High-Speed Processing Symposium.

The two events will be held in conjunction with each other, covering October 14 to 22, 1960. The first event will be the High-Speed Processing Symposium, sponsored by the Society of Photographic Scientists and Engineers (SPSE), October 14 and 15. October 16 will be the beginning of the 5th International Congress on High-Speed Photography, sponsored by the Society of Motion Picture and Television Engineers (SMPTE). The SPSE function will be at the Shoreham, the Congress at the Sheraton Park Hotel.

The SPSE Symposium will cover the technical revolution in high-speed processing and the effect on space and other technical applications of photography. Presiding will be Edward Kaprelian, Assistant Director of Research, U. S. Army Signal Research and Development Laboratories, Fort Monmouth, N. J. He will also speak on "Future Military and Commercial Applications of Short Access Time Rapid Processing."

The keynote address will be given on October 14 by George Eaton, president of SPSE and head of the processing research department, Eastman Kodak Co. The speech will cover "The Revolution in Photographic Processing."

Topics covered will include rapid processing technology, photographic emulsions, development of film-chemical-application combinations, uses for rapid processing, larger processing machines, electrophotography and the future of rapid processing.

In addition to the papers on the topics listed above, a technical exhibit of equipment related to the symposium reports will be held. However, there will not be any general exhibit of photographic equipment. The major goal is described as the exchange of information on "short access time, compact, simplified photographic processing equipment."

The SMPTE High-Speed Congress was endorsed by a resolution of Congress and has received a grant from the United States government. A truly international meeting, the Congress will play host to delegates from 20 countries including Germany, Czechoslovakia, Canada, France, Israel, India, Greece, Great Britain, Belgium, Norway, Japan, U.S.S.R. and Greece.

Papers will be presented with simultaneous interpretations in the official languages of the Congress, English, French and German. Four-channel headsets will be used, very much like those at the United Nations. Three channels will be for the translations while the fourth channel will receive the speaker from the floor. As of this writing, 96 papers have been accepted for presentation, although some will be given only in summary and some only published.

Guest speakers will include Crawford Greenewalt of Du Pont and J. Lewis Powell of the Defense Department.

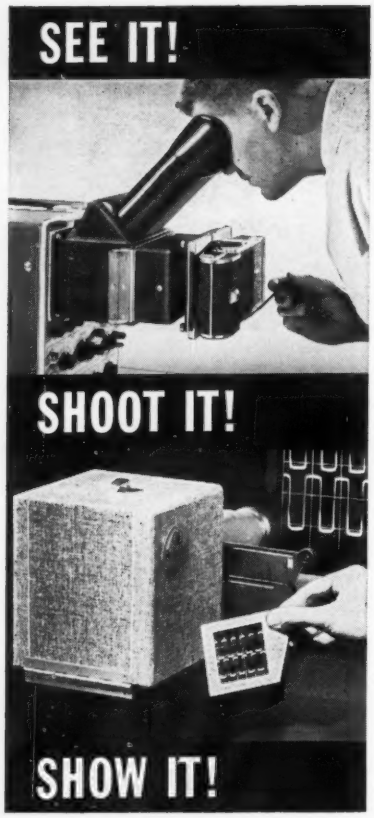
An important feature of the Congress will be the manufacturers' exhibit, showing the latest in high-speed cameras, optics, data-recording equipment, laboratory instruments, etc. Government agencies and research institutions will also exhibit.

Comprehensive program

Each session will cover one specialized aspect of High-Speed Photography. The session subjects include: Short Duration Light Sources; Applications of Light in High-Speed Photography; Electric and Electronic Shutters; Stereo, Spectra and Micro Studies; Cameras: Sweep and Streak; Cameras: Rotating Mirror and Smear; Intensification Techniques; Flash X-Ray; Unusual Techniques; Cameras: Multiple Shuttered; Materials for High-Speed Photography; Applications: Ballistics; Applications: Miscellaneous in Industry; Applications: High-Speed Flow Dynamics; Applications: Survey Papers and Values and Problems of High-Speed Photography.

Heading the Congress will be a 15-man Committee of Honor, prominent scientists and engineers who have consented to serve. They include: Detlow W. Bronk, Edward Curtis, Donald Douglas, Harold Edgerton, James Fisk, T. Keith Glennen, James Killian, Jr., John M. Clark, and Paul Klopsteg.

Also, William Pickering, Simon Ramo, C. Guy Suits, Theodore von Karmen, Herbert F. York, and G. K. Hartman.—THE END



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Ernest E. Reshovsky

PHOTO INSTRUMENTATION

A visit to the 5th Annual Technical Symposium of SPIE in Los Angeles

The first four days of August saw the 5th Annual Technical Symposium of the Society of Instrumentation Engineers (SPIE) held in Los Angeles.

This annual affair packs a tremendous amount of information into a short time, with seminars, workshops and original technical papers being delivered at multiple concurrent sessions.

The Symposium was kicked off by a talk on "Elements of the Photo-Instrumentation System," delivered by Mr. Amrom Katz of the RAND Corp. Mr. Katz, an expert in reconnaissance and intelligence work, did such an excellent job of interlacing the problems of the engineer with those of the laymen, that I feel excerpts from his talk would useful.

"It is convenient to define photo instrumentation as the 'use of photo sensitive materials and systems for the detection and measurement of engineering and scientific phenomena and as an aid to the eye in overcoming its limitation of time, illumination, distance (both large and small), area, and storage ability' . . .

"It appears to me a paradox that the widespread use of photography could and frequently does make for a considerable lack of appreciation of the technology, techniques, and scientific principles involved in its application to engineering problems. I have often observed that amateurs in the bomb and dangerous chemical business blow themselves up. Amateurs working with high powered electrical machinery stand a good chance of eliminating themselves through electrocution. But amateurs in photography can, and frequently do, become critical executives, who tend to minimize misunderstand and confuse problems which seem familiar, easy, and straightforward, because photography is involved. . . ."

Katz went on: "One can conceive of this (photographic systems) in block diagram form, starting with the subject, the illumination on the subject, intervening atmosphere (of more importance in aerial or astronomic photography than in close-up work) and the photographic apparatus itself. This apparatus usually involves a lens, filters as needed, exposure mechanisms a shutter to meter out a prescribed quantity of light and to stop motion, and a rigid mechanism to carry film . . .

"Let us turn our attention briefly to the lens, certainly the cornerstone of all photographic instrumentation. . . . It would take a large number of parameters to describe the characteristics of any lens. The two most common are focal length and its relative aperture, commonly designated as f-numbers. Lenses may be tested for quality of performance in many ways. Up to a few years ago, two of these ways of testing were quite prominent. The examination of the characteristics of the image of a point source of light could often tell an experienced lens designer about various abberations of the lens under examination and their extent. About 20 years ago, lenses for aerial photography started being tested by measuring their performance on a resolution target. As is characteristic in new fields, in the absence of standardization and agreement, it shortly turned out that each laboratory testing lenses designed and used its own target which was then photographed on various materials . . ."

Katz explained that in order to make any use of resolution target tests, one must carefully "specify the contrast of the target, the film used to measure the performance of the lens . . . and some agreement on how indistinguishable the lines have to be in order to say they are no longer distinguishable. The number that is finally produced, such as 20 lines per mm, 40 lines per mm, is really a single point on a curve. What is of much more interest is how the lens is performing, how cleanly the lines are resolved at distances considerably far from the threshold resolution. This operating character-

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istic is not determined at all by the simple measure of resolution. . . . Nevertheless this remains an interesting and useful test. . . . These tests are gradually being replaced or supplemented by sophisticated measurements of the sine wave response of the lens, and by mathematical methods characteristically used in information theory, television and electronics.

"There are, fortunately, two or three simple rules for back-of-the-envelope calculations which enable the non-specialist in this field to quickly come to grips with the limits and capabilities of optical systems:

"The first of these working rules has to do with the angular resolution possible from an optical system of a given diameter. This assumes that the lens is performing at its theoretical maximum limit. Many modern lenses of narrow angle of view (approaching telescopic fields of view) approach or equal this theoretical performance. This rule was developed many years ago by astronomer Dawes, and was applied particularly to consideration of the problem of separation of double stars. . . . Nevertheless, it has considerable value and is worth learning and using. The theoretical angular resolution, in seconds of arc of a system of diameter D inches, equals 4.5/D. Because a second of arc is, roughly, one foot at 200,000 feet, it would appear from this formula that a lens of aperture 4½ in. ought to just resolve two bright points, one foot apart, at 200,000 feet distance. For the case of designers of telescopic-type theodolites, missile tracking systems, aerial cameras, etc. this suggests the minimum diameter necessary for a given application.

Rule for resolution

"Another useful rule gives the resolution in terms of lines per millimeter as a function of lens speed or relative aperture. It is simply this: theoretical resolution of a lens (working in white light) in lines per mm in the focal plane is approximately equal to 1500 divided by the f-number. Thus it appears that a very slow lens, that is one with a large f-number, cannot, in theory, or, in fact, in practice, take as sharp a photograph as a higher speed lens. While this may seem to contradict certain experiences of amateur photographers, experiences which are based on imperfect lenses, it is well known that for good lenses this effect is easily observed. Stopping a lens down makes the lens approach closer to the optical qualities of a pinhole."

(*continued next month*)

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MICROREPRODUCTION
(*continued from page* 63)

use of resolution chart testing is the fact that the measurements are inherently subjective. Interpretations of values tend to vary with the individual. Readings of the same set of test exposures by different individuals, or even by the same individual at different times may vary, sometimes quite widely. Physical condition, fatigue, training and experience all contribute to the situation. The ability of individuals to use a microscope varies. Finally, even though the lines on the test chart have been printed in solid black on pure white, the lines on the microfilm at the higher reductions are difficult to distinguish. They appear under the microscope as granules that may or may not be construed to form a line. Recall that the proper use of the chart requires a determination of the smallest pattern of lines that can be *counted with certaintu*. How certain is certain? Especially if one knows that the lines are there? (*continued next month*)

COMING UP
(*continued from page* 10)

Rochester Chapter SPSE First Monday. Contact Woodlief Thomas, Jr. Color Technology Division, Building 65, Kodak Park, Rochester 4, N. Y. CO 6-2500.

Industrial Photographers of America Essex House, Newark, N. J. Meetings every second and fourth Thursday. Contact Tom Holbarton, 181 Lake Drive West, Packanack Lake, Wayne, N. J. Or R. Handley, The Port of New York Authority, 11 8th Ave., New York 11, N. Y. AL 5-1000, Ext. 605.

National Visual Presentation Association, inc. New York City. Meetings every second Thursday. Contact M. E. Schack, 19 W. 44 St., New York, N. Y. MU 2-2294.

New York Chapter SPIE Meetings every third Thursday. Contact Don Bass, P.O. Box 177, Bethpage, L. I., N. Y. Liggett 4-8196.

New York City Chapter SMPTE Meetings first or second Wednesday of each month. Contact Ed Warnecke, Eastman Kodak Co., 342 Madison Ave., New York, N. Y. MU 7-7080.

Binghamton Chapter SPSE Meetings every third Tuesday. Contact H. G. Morse, Ansco, Binghamton, N. Y. RA 2-4221.

Rocky Mountain Industrial Photographers Meetings every fourth Monday. Contact P. H. Broadie, 2170 S. Lincoln, Denver 10, Colo. Telephone PEarl 3-2200.

FREE LITERATURE

For your copy of any free literature item, circle the appropriate number on the readers' service card, attached, page 77.

AUDIO-VISUAL

A-V EQUIPMENT **201**
Genarco, Inc. 4-page illustrated catalog describes several new models in the Genarco line of slide projectors used for industrial shows, projection of giant images, etc.

FILING CABINETS **202**
Bradford Products Co. 4-page illustrated brochure describes filing cabinets available for sound tape, records, filmstrips, etc. Also lists accessories.

MOVIE-MOVER **203**
H. Wilson Co. Illustrated specification sheet describes the Movie-Mover stand for motion picture or A-V equipment. Includes accessories.

SLIDE BINDER CATALOG **255**
Emde Products, Inc. 4-page catalog describes the complete Emde line of slide binding materials and is three-hole punched for insertion into standard three-ring binder.

RECORDING SYSTEMS **251**
Magnetic Sales Corp. 20-page booklet on synchronous sound recording systems for motion pictures.

ATOMATIC SLIDE MOUNTER **252**
Camomatic, Inc. 4-page illustrated leaflet describes the Camomatic 35mm automatic slide mounter.

EQUIPMENT

RECORDING OSCILLOGRAPH **253**
Electrodynamics Corp. 8-page illustrated bulletin describes in detail the new Type 5-123 recording oscillograph including complete specifications.

TABULATING CARD FILES **254**
Remington Rand. 12-page illustrated brochure dscribes files available for storage of tabulating cards and magnetic tapes.

SHELVING **208**
Equipto. Full details on steel book and library shelving available from this company.

APAC PRINTERS **250**
American Photographic Appliance Corp. 12-page catalog describes the Apac line of automatic enlarging printers and roll paper easels. Also the Photo Eye timer for automatic exposure control.

ROLOR CATALOG **249**
Rolor Industrial Corp. 12-page catalog describes several pieces of color processing equipment made by this firm.

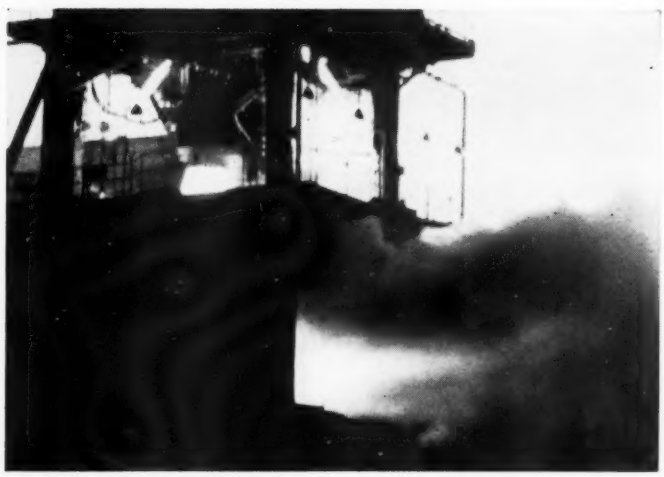
TRAID TECHNIQUES **204**
Traid Corp. 4-page illustrated newsletter, *Traid Techniques*, contains current information on the photo instrumentation field.

MAGNIFIER CATALOG **205**
Bausch & Lomb Inc. 14-page illustrated booklet lists over 65 models (powers from 2X to 20X) of readers and magnifiers. Includes specifications and prices.

LOGETRONICS BULLETIN **206**
LogEtronics, Inc. 4-page bulletin gives the step-by-step production of photodrawings with LogEtronics photo enlarger.

PERFORMANCE CHART **212**
Natural Lighting Corp. Performance chart for lamps boosted with ColorTran converters lists 14 of the most popular lamp types. Also lists typical applications for each type with recommended reflector or housing.

AUTEX* catches the flame



A film sequence of a rocket engine test properly exposed from countdown to flame-out dramatically demonstrates the AUTEX Automatic Exposure Control as a new and versatile tool for the photoinstrumentation engineer. Coupled to any lens this photosensitive servomechanism corrects for light changes as fast as 7 stops per second to record the unexpected along with the normal.

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The new Model VI-4 AUTEX is a typical product of the combined photographic and electronic instrumentation abilities of Flight Research. For detailed information concerning the AUTEX and Flight Research's complete line of photoinstrumentation equipment, write to:

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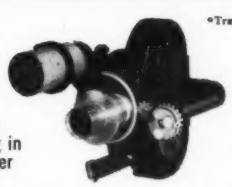

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Richmond 1, Virginia

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DuKane CORPORATION

Dept. PM190 **St. Charles, Ill.**

Get more information. Circle 433, page 77

COLOR PROCESSING EQUIPMENT 213
Carr Corp. 8-page illustrated catalog describes color processing units available from this company. Includes accessories.

NEW LOOK SINKS 214
Leedal, Inc. Illustrated catalog sheet describes and gives specifications for Leedal sinks and stainless steel photographic processing equipment.

CLOSED CIRCUIT TV 209
Television Utilities Corp. 4-page illustrated leaflet describes the Scan-A-Graph "500" closed circuit TV transmitter which operates without a camera.

PLASTIC PLUMBING 210
The Nalge Co. 20-page engineering and parts catalog shows complete line of Vulcathene plastic plumbing equipment. Includes technical and dimensional information.

CONNECTORS 211
Consolidated Electrodynamics Corp. 12-page brochure describes multi-contact connectors for every need. Included are photos and diagrams which describe applications.

MASS SPECTROMETER 262
Consolidated Systems Corp. Bulletin describes a mass spectrometer devloped for space exploration. Includes details of construction, principle of operation and specifications.

LIGHT MEASURING CELLS 263
General Electric. 8-page illustrated bulletin offers complete description of Photovoltaic cells for the precise measurement of light. Includes graphic data on spectral sensitivity, exposure effect, current output and other factors.

CECO BATTERY 264
Camera Equipment Co., Inc. Specification sheet gives data on the CECO Voltabloc nickel-cadmium battery. Includes information on other Voltabloc power supplies and battery packs.

GRAPHIC ARTS

KALVAKARD PRINTER 265
Kalvar Corp. 4-page illustrated laflet gives data on the Kalva-Kard printer which selectively contact prints micro images to Kalva-Kards and various types of Kalfax film products.

FILM READER 215
Recordak Corp. 4-page illustrated folder describes and gives specifications for the Medalist Film Reader for microfilm.

MICROFILM 216
Thermo-Fax Sales, Inc. 8-page reprint from *The Office*, "Let's Take a Positive Look at Microfilm," states the case for microfilm as a clerical tool.

REPRO PAPER NEWS 217
Andrews Paper & Chemical Co., Inc. Bulletin, *Reproduction Paper News*, contains up-to-date information pertaining to the reproduction field.

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. . . on all 16mm/35mm MOTION PICTURE FILM PROCESSING AND PRINTING

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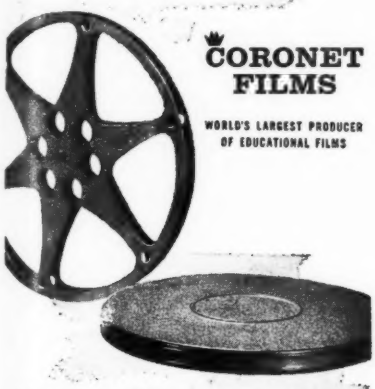

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COPYBOARD LIGHTING 219
Natural Lighting Corp. Illustrated specification sheet describes the ColorTran Superior Jr. Converter which is designed specifically for smaller copyboards.

VERTICAL CAMERA 220
Robertson Photo-Mechanix, Inc. 4-page illustrated folder describes and gives specifications for the Meteorite vertical camera.

MICRO-FILE MACHINE 235
Recordak Corp. Catalog sheet describes the Micro-File machine, Model C-4, designed for photographing large documents and bound volumes.

MOTION PICTURES

PROFESSIONAL 8MM 221
Frederick F. Watson, Inc. 4-page newsletter, *Cine Magnetic News,* features an article on the use of 8mm by professionals.

FILM INSPECTER 222
Paulmar, Inc. 6-page illustrated brochure describes the Paulmar Model 60 unit which offers fully automatic cleaning and inspection of 16mm film. Includes specifications and prices.

SET LIGHTING PACKAGE 261
ColorTran. 4-page illustrated reprint from *American Cinematographer* describes ColorTran lighting system. Includes lighting tables on the Cine King light and the Super Kicker light.

REFLECTOR LAMP 260
Westinghouse Elctric Corp. Looseleaf sheet describes the DVP and DXA 300-watt reflector lamps for high-speed photography. Includes exposure and technical data.

CAMERA & LENS

KONICA QUARTERLY 259
Konica Camera Co. Free subscription to *Koniflashes* a quarterly publication. *Koniflashes* contains how-to articles and suggestions for various techniques that can be employed with the Konica camera and accessories for special effects.

GRAPHIC SOLUTIONS 258
Joseph D. Brubaker. Brochure gives data on 50-page manual, *Keemag Graphic Solutions,* which gives graphic relationships between conjugate focal distances, extension, lens focal length, etc.

KERR CELL CAMERA 257
Electro Optical Instruments, Inc. Illustrated specification sheet gives data on the Model KSC-51 Kerr Cell camera. Includes accessories and prices.

THE ALPA CAMERA 256
Karl Heitz, Inc. 4-page illustrated book review written by Jacob Deschin of *The Alpa Camera,* a 124-page text book on the Alpa, Swiss 35mm camera.

A new screen for viewing pictures in undarkened rooms

It is true that you can project better pictures in darkened rooms—but there are many times when room darkening is inconvenient, difficult and costly. Now, with the new Radiant exclusive "truly lenticular" screen, which controls **both** horizontal and vertical light reflection, you can project slides and movies effectively in normally or partially lighted rooms where no unusual lighting conditions prevail. For industry and business—this permits projection in shows, conventions and offices where room darkening is not practical.

Send for Illustrated Booklet *which gives the complete explanation of this new truly lenticular screen, also catalog giving specifications and prices of Radiant's complete line of lenticular and glass-beaded screens of every type for every purpose.*

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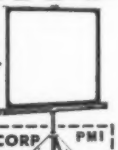

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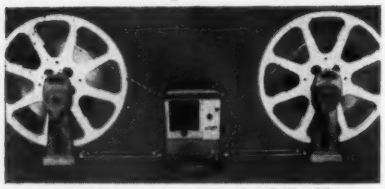

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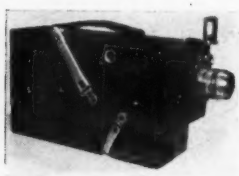

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SERVICES

CONTROLLING COLOR 236
Meisel Photochrome Corp. 24-page illustrated booklet, *Egbert in Colorland,* gives hints and tips on shooting color.

MOVIE PRODUCTION SERVICE 237
Cine-Chrome Productions, Inc. Leaflet describes new motion picture production service for the industrial west available from this California firm.

COLOR PROCESSING 225
George Santillo, Inc. 4-page price list of services available from this New York laboratory.

MOVIE FILM PROCESSING 226
Peerless Film Processing Corp. 6-page price list outlines motion picture services available from this New York firm. Includes a glossary of terms.

COLOR SERVICES 227
Meisel Photochrome Corp. 10-page price list outlines positive and negative color services available from this Texas company.

PRICE LIST 228
Cine-Chrome Laboratories, Inc. 6-page price list also includes brief description of services available from this California lab.

SUPPLIES

FUJI MICROFILM 229
Ideax Corp. Specification sheet gives detailed information on Fuji negative and positive microfilm. Includes charts of sensitometric curves and general processing instruction.

DEVELOPER-FIXER 230
Cormac Chemical Corp. Illustrated folder is designed to answer questions on every aspect of Unibath and Unikit.

RAPID FIXER 231
Edwal Scientific Products Corp. 4-page bulletin describes in detail Edwal Quick-Fix. Includes instructions for use.

GAMMA TABLE 232
Best Photo Industries, Inc. Time-gamma table for 777 Panthermic fine grain developer. Includes developing times and up-to-date processing instructions.

NEOFIN TECHNIQUE 239
The Studiophot Co. 16-page pamphlet summarizes all the latest information on Neofin developers.

NEWS AND VIEWS 223
Gordon Enterprises. 4-page newsletter contains brief items on products handled by this firm.

PLASTIC LAB APPARATUS 234
The Nalge Co., Inc. 24-page illustrated catalog contains information on plastic laboratory apparatus available from this firm. Includes a chemical resistance chart.

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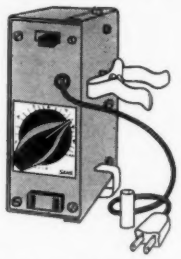
with variable sensitivity control



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NEW PRODUCTS

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COLORTRAN LINE-LITES 108
A new series of ColorTran Line-Lites designed for use with copyboards 41 to 50 in. high is now in production by Natural Lighting Corp. The unit, designated LL-7, can be used with any existing ColorTran converter now in use. $228.50 per pair.

AUTOMATIC FILM SPLICER 109
A new automatic film splicer which uses pressure sensitive Mylar tape is the Unicorn Automatic film splicer. The result is said to be a smooth splice with the Adhesive splicing tape firmly rolled completely around the film, sealing edges. It is available in 16, 35 and 70mm sizes. Price: $2,200 for 16 and 35mm model; $2,700 for 70mm.

CHEMICAL STORAGE TANKS 110
The Arkay Corp. has introduced a line of cylindrical plastic storage tanks made of "extra heavy poly-styron." Available in three models, each tank is equipped with a cover and drain nipple. Spigots and valves are optional equipment. 5, 15 and 25 gal. sizes are available. Price: $11.95, $19.95 and $29.95, respectively.

BLOWER-IONIZER 112
A new long-range static eliminator, called the Aerostat, has been announced by the Simco Co. This device incorporates a static neutralizer-head in the air outlet of a centrifugal blower and is claimed to neutralize static at distance of up to four feet on materials passing through the air stream.

The Aerostat is available in two sizes, the smaller having an effective length of 10 in. and the larger double unit having an effective length of 20 in. They can be provided with light-free shields.

AGOF SCHACHT LENSES 113
A series of new telephoto lenses which are coupled internally to the camera with automatic release, for screw mount cameras, or with outside automatic diaphragm release for bayonet mount cameras. The Travenar f/3.5 135mm automatic 4-element lens covers an 18° angle of view. It focuses from infinity to 5 ft. Price: $89.95. The Travenar f/2.8 85mm lens with a 28° angle of view focuses down to 3.5 ft. Price: $93.95. Travenar f/2.8 90mm is $93.95.

OVERHEAD CAMERA LINE 117
Western Cameras, manufacturers of all metal low bed-type darkroom cameras has announced the addition of a series of overhead models. The new units will include the following sizes: 24 x 24 in., 24 x 32 in., and 32 x 32 in. Features of the cameras are rugged construction; high-speed electric screw driven focusing system, which is said to allow the user to focus within 1/1000 in. A complete line of attachments is available to meet varying requirements of the user.

SAMSON TRIPOD 118
A sturdy tripod for studio cameras to 8 x 10 and for 16mm motion picture cameras is the new Samson Professional by Quick-Set. It weighs only 12 lbs. and its telescoped dimensions are: 6⅝ x 7½ x 44½ in. With legs extended and spread, the unit is 80 in. high. Minimum height is 38 in. The elevator center column is worm gear-driven. A Lo-Hi accessory permits the camera to be lowered to 11 in. above the floor. Pan heads are detachable and interchangeable.

ESTAR BASE FILMS
Five Kodak graphic arts film—all new additions to the Estar Base series—have been announced by the Eastman Kodak Co. They are Kodalith Ortho Matte Film, Type 3, Estar Base; Kodalith Ortho Film, Type 3. Estar Thich Base; Kodalith Pan Film, Estar Base; Kodak Pan Masking Film, Estar Base, and Kodak Autopositive Film, Estar Base.

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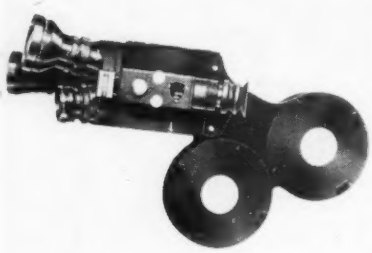
MITCHELL 35MM REFLEX 111

A new 35mm lightweight reflex cine camera has been announced by the Mitchell Camera Corp. Intended for field as well as studio use the camera may be hand-held or tripod mounted during operation. The magazine is located on the underside of the camera and serves as an intergral part of the camera support.

The camera is equipped with dual shutters. The variable disc focal plane shutter operates directly behind the steel aluminized and coated reflex shutter for positive



exposure control, it is said. This shutter may be controlled manually, while the camera is operating, to provide fades and dissolves.

Lenses for the R-35 are Super-Baltars, a new series designed specially for this camera by Bausch & Lomb. Matched f/2.0 lenses in 25, 50 and 75mm are standard equipment. Zoom and anamorphic lenses may be used with the R-35.

The camera movement, which provides speeds from single frame to 120 frames per second, with appropriate motors may be removed and replaced without loss of timing. Dual registration pins and dual pull-down claws are employed. The camera comes with 400-ft. magazine and is adaptable to 1000-ft. magazines.

POLARIZING SPINNER 114

An accessory attachment for use with Beseler VU-Graph projectors recently introduced is said to add the effect of motion on the screen. Called a polarizing spinner, it must be used in conjunction with specially prepared slides. In addition to motion other effects such as fade-ins, fade-outs and color changes can be achieved by moving the same device manually through successive positions. A speed control from 80 to 40 rpm is built in. Price: $85.

RUBYLITE POWER-PAC 115

A completely self-contained power supply furnishing 115-volt AC for operation of the Auricon Cine Voice Camera has been introduced by Photomart. The unit weighs 6 lbs. with its own charger and nickel cadmium lifetime battery. It will run 30 rolls of film without recharging, it is said. Price: $139.50.

UNIVERSAL FILTER HOLDER 116

A universal filter holder adaptable to all size lenses has been introduced by Keith Camera Co. The holder accepts 3-in.-sq. filters in frames or glass. It is attached to the lens mount by means of a thumb screw. Price: $9.95.

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SLIDE MOUNT PROTECTORS 103

A new 2 x 2 aluminum frame to protect cardboard slide mounts has been introduced by Yankee Photo Products. The mount is said to provide the advantage of a metal mount without the need to dismantle the cardboard. Price: 98c per package of 50 protectors.

DARKROOM VENTILATOR 104

A new lightproof ventilator for darkrooms has been introduced by the Ilg Electric Ventilating Co. The unit utilizes a dead-light louver to prevent the entrance of light. In tests, 7000 ft.-candles of light directed against the open side of the fan resulted in a light penetration of only .004 ft.-lambert, according to the manufacturer. An outside wall model has a spring-tight door, which opens automatically when the unit is in use.

ROLL FILM VIEWER 105

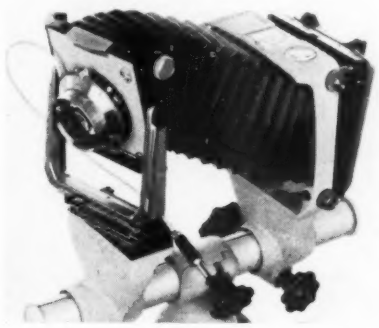
A new film viewer with a 12 x 16-in. lighted surface for viewing aerial roll film has been announced by the Kargl Co. Spool holders for 9½ in. aerial roll film are supplied with the unit. Auxiliary spool holders for 105mm, 5¾ and 7-in. widths are available. Price: $72.50.

SPRAY-VUE SLIDES 106

A new plastic slide material which can be ready for projection in a matter of minutes is the Spray-Vue plastic slide. Each slide has a frosted surface on which artwork or tabulation may be typed or sketched. After the desired information is applied the slide is coated with Spray-Vue lacquer and the frosting disappears. The slide is then ready for projection. The Spray-Vue material is available in 35mm to 10 x 10 in. sizes. Price: $2.75 to $7.50 depending on size.

LINHOF-COLOR 23 101

A 2¼ x 3¼ monorail view camera has been added to the line of Linhof products. Designated the Linhof-Color 23, it will accomodate lenses from 47mm to 360mm. Bellows extension is 11¼ in. The front standard of the Linhof-Color is identical with that used on the Linhof-Super Technika 4 x 5 camera, providing up to 15°



forward and back tilt as well as left and right swing. Lateral shifts up to 1 in. right or left of center are possible. The 360° revolving back incorporates the Linhof "quick change" release which permits a changeover from ground glass to the Super Rollex back. Weight of the camera is 4½ lbs. Price: $249.50.

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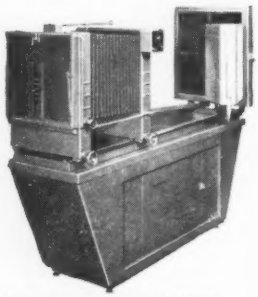

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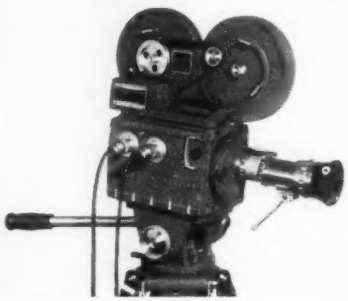
LIGHTWEIGHT AURICON CAMERA 107

A new lightweight version of the Pro-600 camera has been announced by Bach Auricon Inc. Designated the Pro-600 Special, Model CM-77, it is a 16mm, all-transistor-



ized sound-on-film camera featuring a 32 per cent weight reduction over the heavier studio model. Film capacity is 400 ft. with the new lightweight magazine, which will also handle 100-ft. spools for short "takes."

EDNALITE POWERSCOPE 120

The Powerscope, a self-illuminated visual assist magnification system that is said to produce a distortion-free, color-corrected image up to 7X actual size has been announced by The Ednalite Optical Co., Inc. The optical system of the Powerscope consists of a precision ground, color corrected combination of lens elements that provide 2.5X magnification said to be free of distortion factors. An additive lens cell, said also to be highly corrected, bayonet mounts on the basic lens system, increasing magnification to 3.5X. A knob-controlled, built-in magnification multiplier lens on the standard model swings under the optical system to double its power for critical viewing.

The Model 150A-7X Powerscope, with 2.5X and 3.5X lens system with built-in achromatic magnification multiplier sells for $144.50. Model 150-3.5X Powerscope without achromatic magnification multiplier lens assembly is $129.50. Model 150-2.5X Powerscope without magnification multiplier assembly and additive achromatic lens sells for $99.50.

FOCUSING GROUND GLASS 121

A ground glass focusing attachment said to provide parallax-free framing, critical focus and depth of field control is now available for the Robot Electro-Automatic Photo Recording System (which consists of the Robot Royal and Recorder 36, 24 and 18 single frame automatic 35mm cameras with booster motors, 30 or 200-ft. magazine, remote releases, etc.).

The adjustable metal frame of the ground glass attaches to the accessory shoe of the camera and is held flush against the focal plane by pressure of a spring joint. Price: $12.90.

HI-FI ENLARGER 122

The Microcopy High Fidelity Enlarger Model 120, said to be a high precision continuous flow slit type microfilm enlarger has been announced by Microcopy Inc. The image is projected from the film negative to a slit that permits the exposing

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of sensitized material as it moves past. The mechanical drive is directly connected to both film and sensitized material, thus, they are locked together at all times, it is claimed. The enlarger also provides a screen for checking and selecting frames from rolls. It enlarges from 35mm film to 10-in. width paper at speeds said to be 20 ft. per min. on 1000-ft. rolls and prints from Filmsort cards, IBM cards or roll film. The unit is 24 9/16 in. long, 27 in. high and 16⅝ in. wide.

TIMBER-TOPPER **102**

With a device called Timber-Topper and an ordinary 2 x 3 stud, a temporary, removable support post can be made quickly, according to the manufacturer Reproduction Engineering Corp. The unit consists

of a metal sleeve measuring 12 x 2 x 3 in. which has a coil spring inside it. To erect a post, the Timber-Topper is slipped over the end of the stud which has been cut to the correct floor to ceiling measure, and pushed in place. Such supports are said to be suitable for mounting lights and reflectors at field locations as well as in the studio. Price: $3.98.

NON PERSPECTIVE

(*continued from page 55*)

ducible for diazo prints.

P&G uses a vacuum printing frame to make the screen positive, exposes it with a 100W point source of light 6 ft. away for about 5 sec. After scaling, additional drawing and notations are made on the screened positive, it is used as a master for working drawings on plasticized diazo paper.

P&G considers the system still in the development stage, and hasn't yet established an economic justification, according to Mr. Hammond. P&G estimates the cost of a B or C size reproducible made by the system described to range between $54 and $167.—THE END

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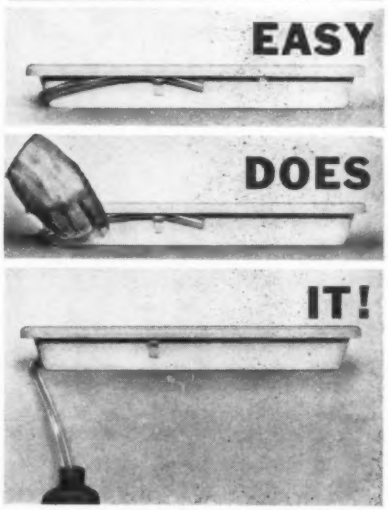

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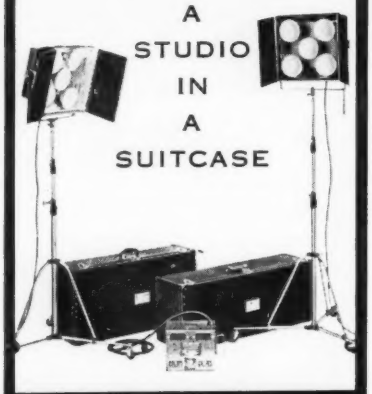

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PICTURES CALIBRATE METERS

(*continued from page 67*)

drawn from the fact that enough fuel passes through the 1000-lb. Turbo-Meter in six seconds to power the family car for one year.

Testing is worth a fortune an hour, and any delays caused by darkroom film processing would seriously disrupt test schedules and provoke added expense.

We purchased two Speedliner Polaroid Land cameras in June, 1957, and installed them on the test line: one facing the register head on the Turbo-Meter and the other facing the scale.

(The scale is so sensitive that both it and the weigh tank are housed in a small temperature-controlled building to protect them from changes in climatic conditions. It's therefore separated from the Turbo-Meter which remains outdoors as it would be when actually used in the field.)

The shutter on each Polaroid camera is connected to a thin air hose, which leads off a small bicycle-type pump located near the meter. This enables one man to fire both cameras at exactly the same time by simply pushing down the pump handle. This cuts in half our man power requirements compared to the old "human eye" system.

Before a test begins, an engineer shoots a couple of "sample" photos to make sure he has the proper exposure. During the test itself, he takes simultaneous photographs of the register head and scale at intervals varying from 3 to 20 minutes. This time lapse between pictures depends upon the rate of liquid flow through the meter, which is pre-set by an automatic flow control valve. The Division's engineers shoot more than 100 pictures per month. We estimate the cost of each print at about 27¢ for materials—less than $500 per year.

The cameras easily "stop" the rapidly-spinning register drums and fast-moving scale needle, and within minutes after the test run is completed, the engineer can provide our research analysts with a series of on-the-spot photos—"readings" of exceptional accuracy.

Comparative data from pictures taken during additional test runs is used to check the Turbo-Meter's repeatability, and a copy of the final performance curve travels with the meter to provide Rockwell's customer with verification of the instrument's accuracy—which can be as high as 0,05 per cent.—THE END

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for the particular artist
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Number 52

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Write for price list and descriptive folder

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Protect your slides

A Multiplex slide file cabinet *protects* slides against damage or loss . . . has cylinder type key lock. Also provides for *orderly classification* by product, location, year, etc. And it is *convenient*—slides can be viewed without removing from slide frame. Cabinet shown holds 2340 slides 2"x2" . . . or 780 slides, 4" x 3¼" or some of each. Other capacities available. Office furniture gray or green. For Bulletin LS-158, print your name and address in margin and mail this ad to:

MULTIPLEX
DISPLAY FIXTURE CO.
Dept. S60, 931-941 N. 10th St., St. Louis 1, Mo.
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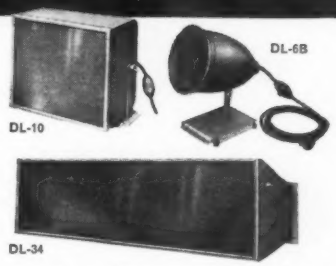

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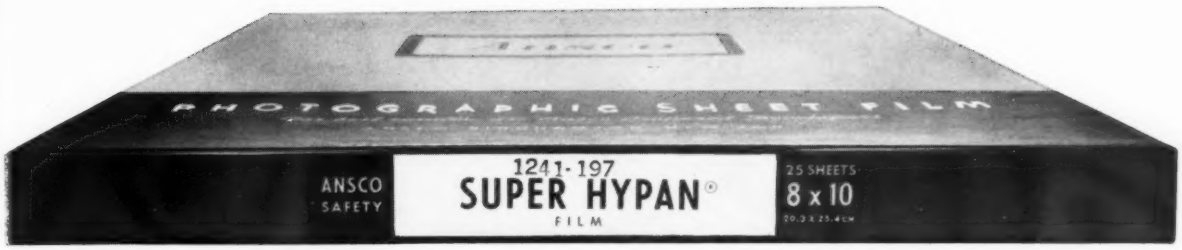

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